AVIATION WEEK

A McGRAW-HILL PUBLICATION

50 CENTS

The First Production-Line Airborne

Transistors Fly on the F11F

THE Grumman F11F Tiger represents a significant advance in carrier-borne fighters—for a number of important reasons.

Not the least of these are her low drag characteristics—the result of a wasp-waisted fuselage and high density design.

Important, too, is a new instrumentation feature, her Honeywell Transistor Fuel Measurement System—first transistorized *production-line* device to fly.

The new Transistor Fuel Gage has all the accuracy of the famous Honeywell electron-tube gage, but is lighter, smaller, and requires less than half the power. It has been flight tested extensively on many commercial and military aircraft.

Transistors have an exceptionally long life, and are extremely resistant to shock and vibration. Unlike electron tubes, they needn't be accessible for easy change. In the new gage they are sealed within the indicator itself—hermetically protected from dust and accidents.

The long-life characteristic also makes the new transistorized gage the most reliable available today. Designed to meet all military specifications, it operates from minus 65° to 160° F.

Electronic Fuel Measurement Systems for aircraft and missiles—including the new transistorized version—represent only one group of the many Honeywell products in our line of controls for everything that flies. We expect the list to grow longer in future years—because automatic controls are so important to aviation progress. And *automatic control* is Honeywell's business.

MINNEAPOLIS

Honeywell

Aeronautical Division

2600 Ridgway Road, Minneapolis 13, Minn.

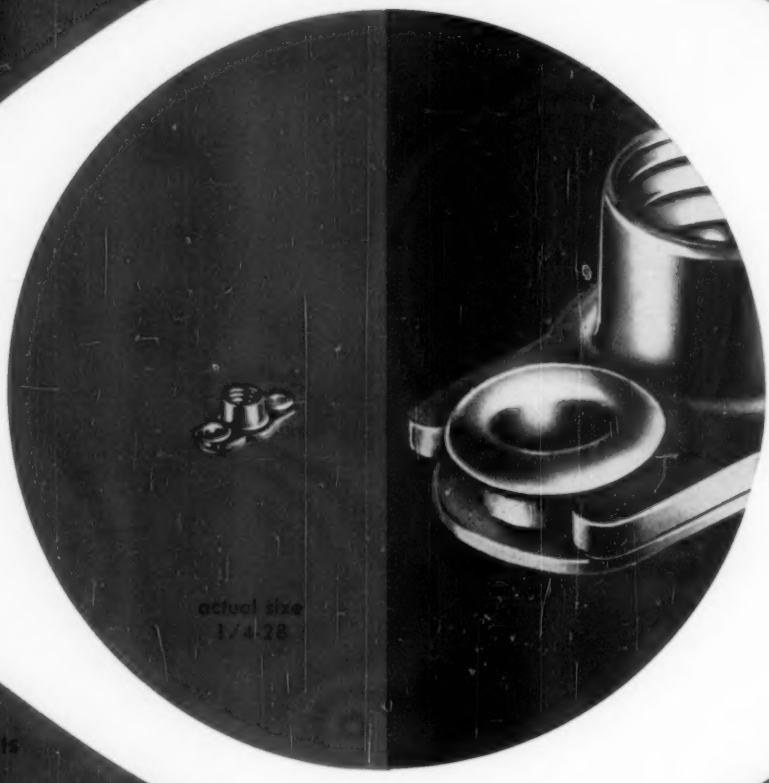
JUNE 27, 1955

E B POWER
UNIVERSITY MICROFILM INC
313 N 1ST ST
ANN ARBOR MICH

another first

a miniature floating anchor nut

KAYLOCK
TRADE MARK
ALL METAL SELF-LOCKING NUTS



Kaylock sets the pace again for the self-locking nut industry with this all new precision full floating anchor nut which exceeds the performance requirements of Air Force-Navy specifications.

For more information mail coupon today

The Kaynar Company — Dept. K-4
P.O. Box 2001 Terminal Annex
Los Angeles 54, California

Please send me the following:

_____ Additional Technical Data.
_____ Samples:
_____ Standard
_____ Miniature
_____ Ask your representative to call.

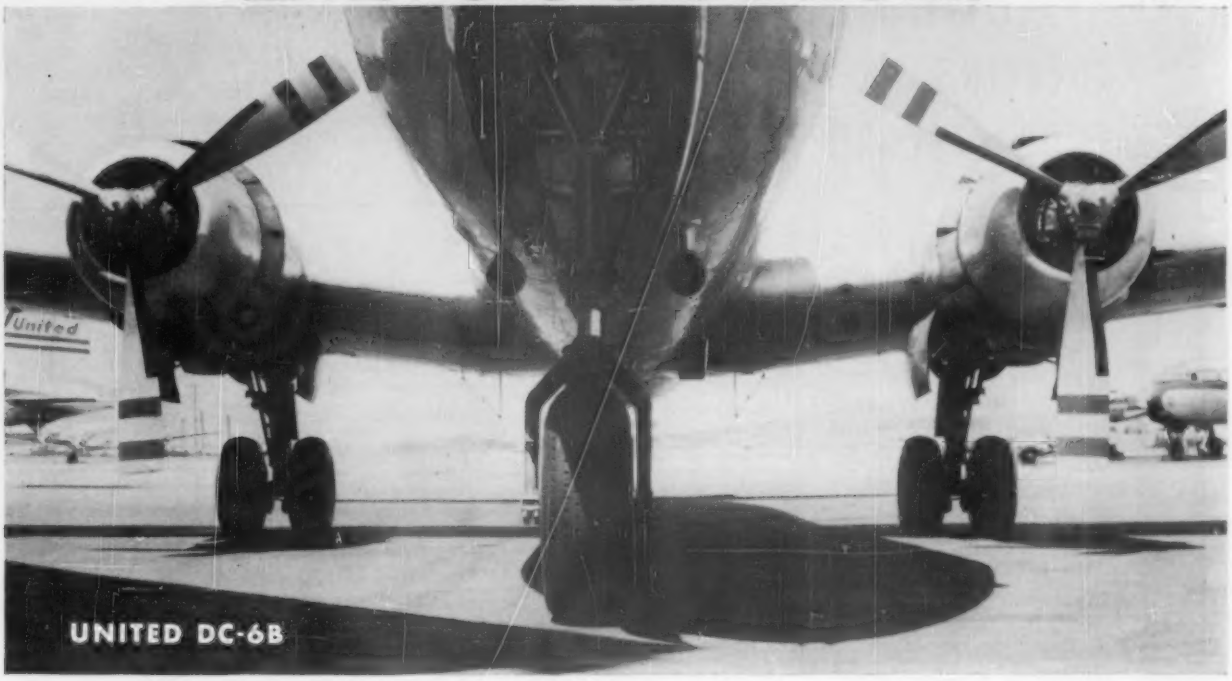
Name _____
Position _____
Company _____
Address _____
City _____ State _____

- **smallest** Less than ½ size of conventional floating anchor nut
- **lightest** One-third the weight of conventional floating anchor nut
- **strongest** in torque-out, push-out exceeding military requirements
- **interchangeable** with fixed anchor nuts
  - Same rivet size
  - Same rivet hole spacing

THE KAYNAR COMPANY • KAYLOCK DIVISION • BOX 2001, TERMINAL ANNEX • LOS ANGELES 54, CALIFORNIA

Canadian Agent: Aircraft Accessories Limited, Montreal

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



WORLD'S FIRST ALL TUBELESS AIRLINER is B. F. Goodrich equipped!

TUBELESS TIRES are now flying the airways. This United DC-6B Mainliner is the first plane to be completely Tubeless equipped and CAA approved for scheduled, commercial service. And it's equipped by B. F. Goodrich, inventor of the Tubeless Tire.

Greater pay load is one of the big advantages in switching to this new tire design. B. F. Goodrich Tubeless Tires on this airplane represent a weight reduction of approximately 48 pounds under regular tires and tubes.

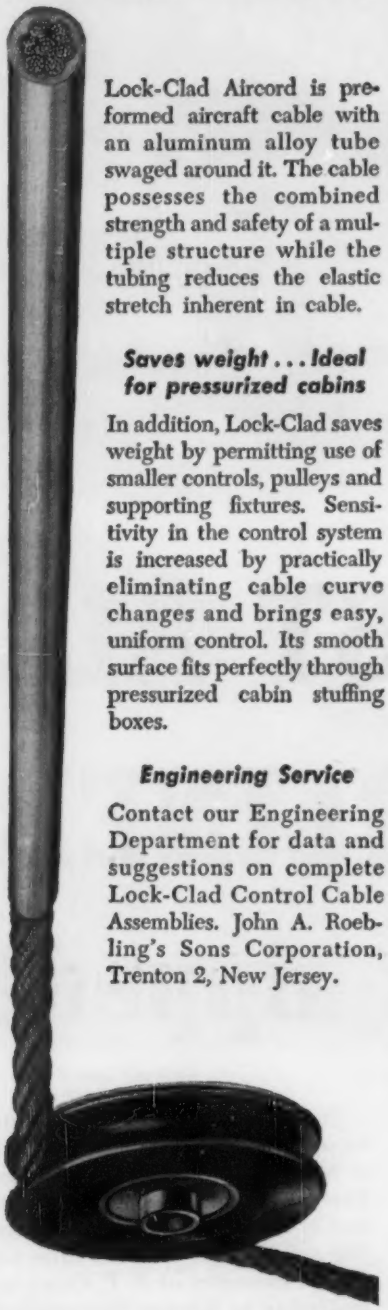
In addition, B. F. Goodrich Tubeless Tires save time and money in warehousing and maintenance. Instead of a tire and tube, there's only the tire to purchase and stock—only the tire to mount and service. And the exclusive BFG dimpled tread design distributes tread loads more evenly, gives slower wear and less tread cutting.

There are specific safety features, too: no tube to chafe or leak—no tube to bunch or shift during take-offs and landings. A patented inner liner, built as an integral part of the B. F. Goodrich Tubeless Tire itself, replaces the conventional tube and retains correct inflation pressure much longer.

The B. F. Goodrich Tubeless Tire for commercial planes is the flying mate of two other BFG airplane Tubeless Tires; the high-pressure Tubeless Tire used by fast fighters and the world's first 300 mph Tubeless Tire. All three are typical examples of B. F. Goodrich leadership in Tubeless Tire research and development. *The B. F. Goodrich Co., Aeronautical Sales, Akron, Ohio.*

B.F.Goodrich
FIRST IN RUBBER

FOR HIGHER
AE VALUES...
ROEBLING
LOCK-CLAD AIRCORD



Lock-Clad Aircord is preformed aircraft cable with an aluminum alloy tube swaged around it. The cable possesses the combined strength and safety of a multiple structure while the tubing reduces the elastic stretch inherent in cable.

Saves weight... Ideal for pressurized cabins

In addition, Lock-Clad saves weight by permitting use of smaller controls, pulleys and supporting fixtures. Sensitivity in the control system is increased by practically eliminating cable curve changes and brings easy, uniform control. Its smooth surface fits perfectly through pressurized cabin stuffing boxes.

Engineering Service

Contact our Engineering Department for data and suggestions on complete Lock-Clad Control Cable Assemblies. John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

Aviation Week

JUNE 27, 1955 VOL. 62, NO. 26

Editorial Offices
New York 36—330 W. 42nd St., Phone LOngacre 4-3000 (Night LO 4-3035)
Washington 4, D. C.—National Press Bldg., Phone National 8-3414
Los Angeles 17—1111 Wilshire Blvd., Phone MAdison 6-4323

Table of Contents on Page 8

56,269 copies of this issue printed

Robert W. Martin, Jr. ..... *Publisher*
Robert B. Hotz ..... *Editor*

Alpheus W. Jessup ..... *Managing Editor*

David A. Anderton ..... **Engineering**
Irving Stone ..... **Technical**
G. L. Christian .. **Equipment, Maintenance**
Katherine Johnsen ..... **Congress**
Philip Klass ..... **Avionics**
Claude O. Witze ..... **Military**
Craig Lewis ..... **Transport**
Preble Staver ..... **Transport**
Erwin J. Bulban ..... **Business Flying**
William J. Coughlin ..... **West Coast**
Bernie Lang ..... **West Coast Assistant**
Henry Lefer ..... **News Desk**
Gordon C. Conley ..... **News Desk**
G. J. McAllister .. **Washington News Desk**
Lawrence J. Herb ..... **Art Editor**
Victoria Giaculli ..... **Editorial Makeup**
Jerome E. Kelley .. **Printing & Production**

DOMESTIC NEWS BUREAUS

Atlanta 3 ..... 801 Rhodes-Haverty Bldg.
Chicago 11 ..... 520 No. Michigan Ave.
Cleveland 15 ..... 1510 Hanna Bldg.
Detroit 26 ..... 856 Penobscot Bldg.
Houston 25 ..... 1303 Prudential Bldg.
Los Angeles 17 ..... 1111 Wilshire Blvd.
San Francisco 4 ..... 68 Post St.
Washington 4 .. 1189 National Press Bldg.

FOREIGN NEWS SERVICE

Editor ..... John Wilhelm
London ..... Edward W. S. Hull
Paris ..... John O. Coppock
Bonn ..... Gerald W. Schroder
Mexico City ..... John H. Kearney
Rio de Janeiro ..... Peter Weaver
Tokyo ..... Dan Kurzman
Bombay ..... Gordon Graham

Aviation Week is served by PRESS ASSOCIATION, INC., a subsidiary of Associated Press.

Research and Marketing: Irina Nelidow, Mary Whitney Fenton, Jeanne Rabstejnek, and Mildred Raba.

J. G. Johnson ..... *Business Manager*

T. B. Olsen, **Promotion Manager** M. V. Cockren, **Production Manager**

Sales Representatives: J. C. Anthony, **New York**; H. P. Johnson, **Cleveland**; D. T. Brennan and J. S. Costello, **Chicago** and **St. Louis**; E. P. Blanchard, Jr., **Boston**; James Cash, **Dallas**; William D. Lanier, Jr., **Atlanta**; T. Evans Wyckoff, **San Francisco**; C. F. McReynolds and Gordon Jones, **Los Angeles**; W. S. Hessey, **Philadelphia**; C. A. Ransdell, **Detroit**. Other sales offices in **Pittsburgh, London.**

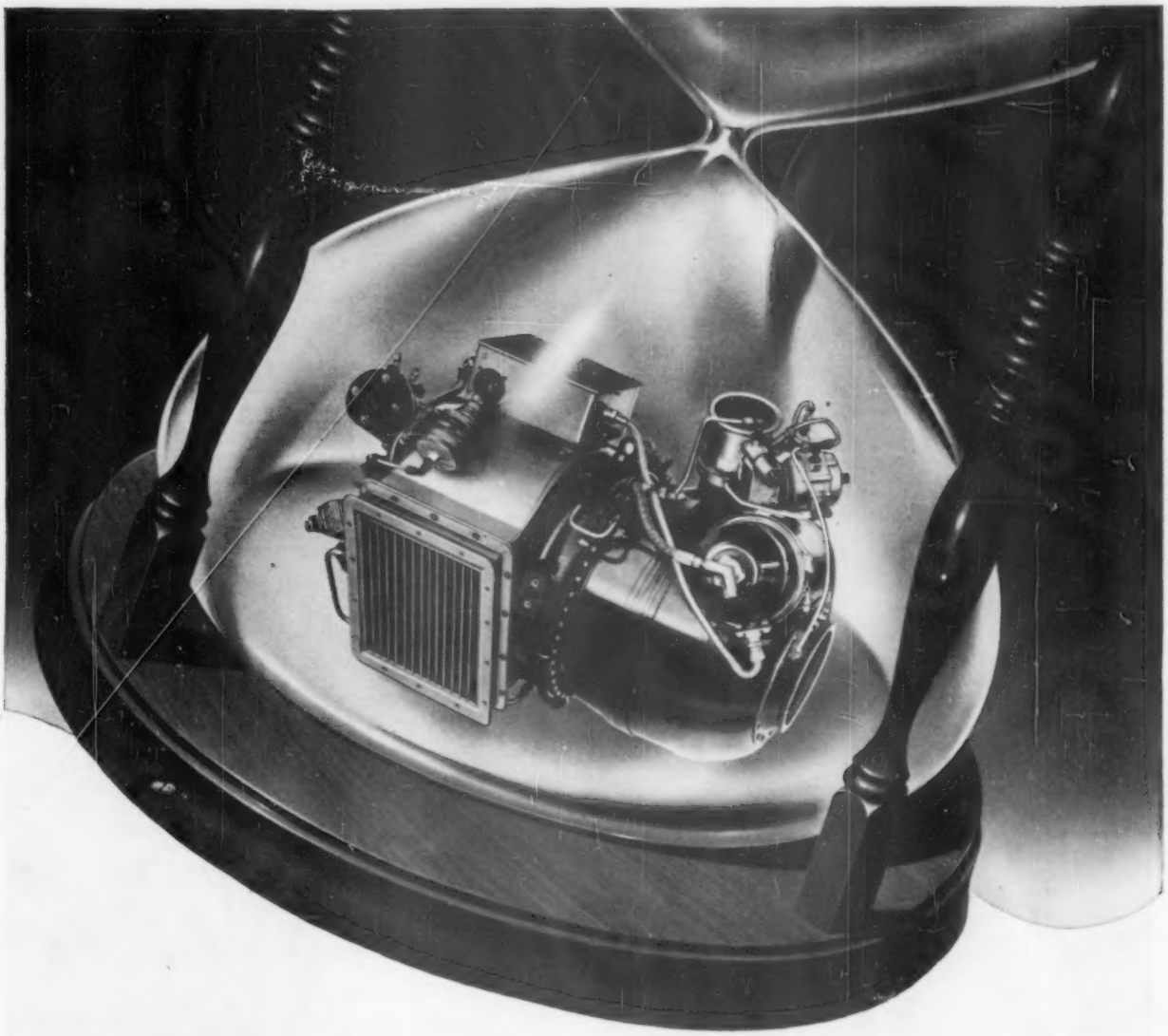
AVIATION WEEK • JUNE 27, 1955 • Vol. 62, No. 26
Member ABP and ABC

Published weekly by the McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. Executive Editorial, Advertising and Subscription Offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Offices: 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscription: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 West 42nd St., New York 36, N. Y. Allow 10 days for change of address.

Subscriptions are solicited only from persons who have a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.

Single copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par. Other Western Hemisphere and the Philippines $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Entered as second class matter July 16, 1947, at the Post Office at Albany, N. Y., under Act of Mar. 3, 1879. Printed in U. S. A. Copyright 1955 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved. Cable Address: "McGraw-Hill New York." Publications combined with AVIATION WEEK are AVIATION, AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL. All rights to these names are reserved by McGraw-Hill Publishing Co.



Small gas turbines pass test of time

New Milestones Gain Industry-wide Acceptance for AiResearch Power Turbines

AiResearch small gas turbine engines, first of this revolutionary class of turbomachinery to be developed, have now passed the following important milestones:

• 100,000 hours of actual service in the field • Successful operation up to altitudes of 53,000 feet • Completely reliable automatic control on production machines • Customer established overhaul periods of up to 600 hours on existing units • Design overhaul periods on new models of 1000 hours • All phases of military qualification (Including new shaft power and gas turbine compressor designs).

Pioneer in this field, AiResearch is first to develop and deliver combination units capable of delivering either shaft or bleed air power independently of each other. AiResearch has more experience with small gas turbines than all other manufacturers combined.

We are proud of the engineering-manufacturing team that has made possible these outstanding contributions to industry.

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

Los Angeles 45, California • Phoenix, Arizona

Designers and manufacturers of aircraft components: REFRIGERATION SYSTEMS • PNEUMATIC VALVES AND CONTROLS • TEMPERATURE CONTROLS CABIN AIR COMPRESSORS • TURBINE MOTORS • GAS TURBINE ENGINES • CABIN PRESSURE CONTROLS • HEAT TRANSFER EQUIPMENT • ELECTRO-MECHANICAL EQUIPMENT • ELECTRONIC COMPUTERS AND CONTROLS

GFR*
NOW... a new fabrication technique
for production of jettisonable fuel tanks
and other aircraft and missile components
from non-critical materials.
RESEARCH • DESIGN • DEVELOPMENT • PRODUCTION
PASTUSHIN
AVIATION CORP. Los Angeles, Calif.
*GLASS FIBER • RESIN
Engineers: If you are not now employed in a defense industry, submit resume.

NEWS DIGEST

McDONNELL F-101 VOODOO takes off with three external fuel tanks during simulated "heavy-weight-condition" flight tests. Location of fuel tanks on the long-range Air Force fighter's fuselage was dictated by inability of the Voodoo's thin swept wings to support tip-tanks. Projections on the ends of fuel tanks may be drop valves. Also note unusual slots on F-101's fin for its "flying tail" elevator.

Domestic

Pratt & Whitney Aircraft is modifying a Douglas C-124 to take the T57 turboprop in the nose as a flying test bed for first flight tests of the giant split compressor engine. T57, earmarked to power the Douglas C-132, 50-ton-payload transport, is now running on the test stand but has not yet undergone the required 150-hour official type test.

The Ford Motor Co. has new contracts to build P&WA J57 turbojet engines at Dearborn, Mich., for Air Materiel Command. The contracts, with a total value of $195,572,897, call for production of 763 powerplants. Three versions are included: J57-29W, -21 and -19W.

Fairchild Engine & Airplane Corp.'s Aircraft Division received a USAF contract for 73 more C-123Bs. The award increases to nearly 240 the number of assault transports scheduled for production at Fairchild's Hagerstown, Md., plant. Air Force may accept its first fully operational C-123 today (June 27). The plane will be used by USAF's first fixed-wing assault-transport unit, the 309th Troop Carrier Group, to be activated next month at Ardmore AFB, Okla.

Pan American World Airways ordered Model AVQ-10 C-band airborne radar from Radio Corporation of America for installation on PAA's entire fleet of DC-6s and DC-7s. Value of the contract: $2 million.

Northwest Orient Airlines is testing Bendix X-band airborne radar in regular passenger flights on a Boeing Stratocruiser. Evaluation unit cost approximately $40,000, including installation, a spare and test equipment. If adopted for NWA's fleet, the price will be about $14,000 per plane plus $6,000 for each installation.

Convair-Fort Worth was awarded a multi-million-dollar Air Force contract to convert 36 Air Force C-54s to air rescue configuration. Conversion to SC-54 calls for larger fuel tanks, navigation and avionic search devices, blister windows and rescue equipment. First plane is scheduled for delivery next fall.

Tanker tests will begin on Boeing Airplane Co.'s Model 707 jet tanker-transport prototype this summer at Seattle. Installation of flight refueling equipment has started on the jet and is expected to take several weeks.

Kaiser Metal Products, Inc., will build additional B-57 wings for Glenn L. Martin Co. under a new $10 million contract. The award extends production of B-57 wings at Kaiser's Bristol, Pa., plant through July 1956.

Financial

Northrop Aircraft, Inc., reported net income of $8,999,382 for the nine months ended Apr. 30, a nearly five-fold increase over $1,854,856 for the same fiscal period last year. Consolidated sales and other income totaled $214,937,363, compared with $109,646,969 last year. Backlog Apr. 30: $306 million, compared with $366 million Jan. 21 and $559 million a year ago.

Ryan Aeronautical Co.'s net earnings during the first half of Fiscal 1955 declined to $796,596 from $1,054,088 for the comparable six-month period last year. Net sales and other income were $19,444,115, compared with $23,540,785. Backlog Apr. 30 dropped to $32.6 million from $39 million Jan. 31.

International

South Korean Air Force received four North American F-86 Sabres from USAF last week, the Republic's first U. S. turbojet aircraft. At least three squadrons are expected to be transferred during the next year. Deliveries increased South Korea's military aircraft to 144. In North Korea, unconfirmed reports claimed the Communists now have 235 MiG-15s.

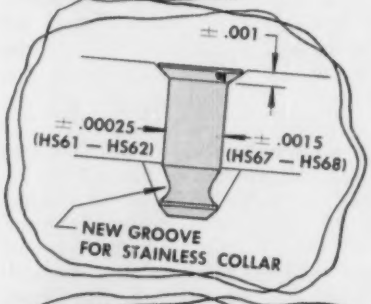
Pacific Western Airlines took a 30-day option to buy Queen Charlotte Airline, a surprise twist after years of tough competition between the two rival British Columbia carriers. Announcement of the proposed merger came shortly after QCA President A. J. Spilsbury rejected earlier PWA overtures (AW June 6, p. 7). Purchase price was understood to be well over $1 million.

125,000 psi shear hi-shear® rivets

31% STRONGER IN SHEAR THAN NAS BOLTS— TENSILE EQUAL TO AN BOLTS

900° F. HEAT RESISTANT FOR AREAS OF ENGINE HEAT AND SKIN FRICTION

TOPS FOR FASTENING 17-7PH AND TITANIUM MATERIALS



AVAILABLE IN 1/8 THRU 3/8 DIAMETERS— OVERSIZE 1/32 AND 1/64 FOR SALVAGE

U.S. and foreign patents — Trademark registered.

hi-shear RIVET TOOL COMPANY
9824 BELLANCA AVENUE • LOS ANGELES • CALIFORNIA

The Aviation Week

June 27, 1955

Management

USAF to Speed F-101, F-104 Output... 12
New Guide for Defense News..... 13
Allen Refutes Subsidy Charges..... 14
News Digest 7
Industry Observer 9
Who's Where 9
Washington Roundup 11

Aeronautical Engineering

Turbine Betters Copter Performance... 28
Supersonic XF8U-1 Details Revealed... 15
British Destroying Six More Comets... 16
French Fly Rocket, Ramjet Fighters... 17
Armstrong Whitworth Opens Tunnel.. 21
Thrust & Drag..... 34

Air Transport

S&W Plans Atlantic Cargo Schedule... 87
Lockheed Offers New Airfreighter..... 91
State Studies Bilateral Criticisms..... 92
Gewirtz Hits House Monopoly View... 92
CAA Tests Ditching..... 97
Senate Boosts Subsidy Fund..... 98
Pearson Is Elected ATA President..... 94
Airlines Will Seek Balboa Agreement.. 94
Piedmont Aviation Wins CAB Support 94
CAB Stands Pat in Pacific Case..... 22
CAB Orders 98

Production

Fighters Use Resin-Bond Honeycomb.. 36
Converted Millers for F-100..... 39

Avionics

Theory of Field-Effect Transistor..... 50
Avionic Industry's Job Outlined..... 21
Avionics Bulletins 57
Filter Center 58

Business Flying

Beech Should Decide on Jet by Fall... 44
Private Lines 47

Financial

New Aircraft Order Lag Continues.... 25
Navy Contracts 26
BuAer Contracts 26
USAF Contracts 48

Equipment

New Aviation Products..... 65

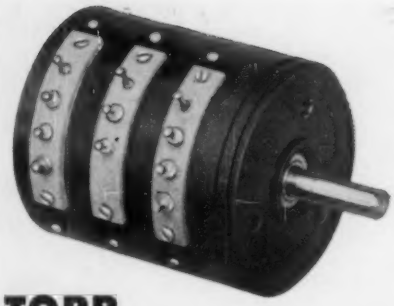
Aviation Safety

One-Engine Procedure Not Used..... 68

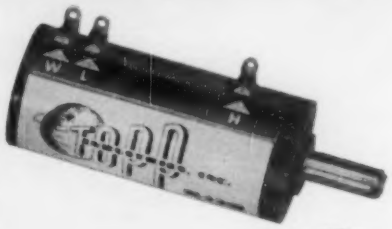
Editorial

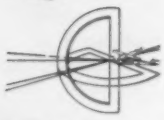
The Poisonous Fog of Censorship.....102

Calendar 60



TOPP POTENTIOMETERS





HEART OF PRECISION CONTROLS— NOW WIDELY AVAILABLE

Until now, you've seen Topp's precision potentiometers only as integral parts of the widely used Topp Mach-sensing and calculating devices and angle-of-attack instruments.

Now, expanded production makes these highly reliable potentiometers available to all manufacturers of electronic equipment.

Topp potentiometers have an outstanding record of high reliability. The full line includes the most modern designs in linear and non-linear types; single turn, rectilinear motion and multi-turn; with servo flange, threaded bushing and tapped hole mounts. A custom design and manufacturing service is available for unusual needs.

Bring your potentiometer problems to TOPP. Write or wire for information and potentiometer catalog.

TOPP INDUSTRIES, INC.
5255 West 102nd St., Los Angeles 45, California

WHO'S WHERE

In the Front Office

Gen. Benjamin Chidlaw, retired commander, Air Defense Command, appointed general advisor and consultant to the president of Thompson Products, Inc., Cleveland.

Jose Lopez Vilaboy returned to Cubana de Aviacion as president. During Lopez Vilaboy's leave of absence, administration of Cubana was handled by the Banco de Fomento Agricola e Industrial.

Commodore Harold P. Sears, Assistant Chief of Naval Staff (Air) of the Royal Canadian Navy. Sears is on loan from British Royal Navy.

B. M. Doolin resigned as aeronautics director of the California Aeronautics Commission.

A. P. Henry, vice president, and **I. L. Ashkenas**, chief engineer, of Control Specialists, Inc., at Inglewood, Calif.

Honors and Elections

W. A. Patterson, president of United Air Lines, elected chairman of Flight Safety Foundation's Industry Advisory Committee for 1955. Vice chairman: **William Littlewood**, vice president of American Airlines.

Charles A. Grinyer, vice president and chief engineer of A. V. Roe Canada's Orenda Engines, Ltd., appointed a member of the Hawker Siddeley Group Design Council.

E. H. Heinemann, chief engineer of Douglas Aircraft Co.'s El Segundo Division, awarded the Paul Tissandier Diploma by the Federation Aeronautique International at its general conference in Paris.

Changes

Robert F. Jones, executive assistant to the vice president-engineering, and **D. R. Tacke**, chief of development, Temco Aircraft Corp., Dallas.

Vernon R. Quinby, manager of the Industrial Associates Division of Dumont Aviation Associates, Long Beach, Calif.

D. C. Burrows, controller of Convair-San Diego Division of General Dynamics Corp.

Milo L. Voight, controller of Norden-Ketay Corp., New York. Other changes: **Leslie M. Slote**, industrial relations director; **Bernard Levine**, director of design and application engineering, and **Charles W. Stanley**, senior nuclear chemist.

Edward P. Gebhard, technical director of M. W. Kellogg Co.'s Defense Products Division, Jersey City, N. J.

B. A. Daley, chief engineer of the Defense Division of Servel, Inc., Evansville, Ind.

W. H. P. Drummond, assistant director-engineering for Douglas Aircraft Co., Santa Monica, Calif. Also promoted: **E. T. Bush**, assistant director of field and lab operations: **J. F. Martin**, assistant director of flight, and **B. A. Foulds**, chief pilot.

Emo D. Porro, engineering assistant to the director of Stanford Research Institute.

Edward M. Owen, manager of Rheem Manufacturing Co.'s Washington, D. C., office.

INDUSTRY OBSERVER

► Republic F-105 supersonic fighter-bomber prototype is due at Edwards AFB early in July for initial flight testing several months ahead of schedule.

► **Boeing will increase its B-52 production rate from 10 planes to 13 planes per month under the accelerated program recently ordered by USAF as a result of disclosures of Russian progress in long range jet bomber development (AW May 23, p. 13). Information on the new rate comes from Aeronca Mfg. Corp. which is the sole source for B-52 spoilers, ailerons rudders, wheel well doors, bomb doors and radar capsules.**

► Northwest Airlines Super Constellation almost ditched 7 hr. out of Tokyo because lowering fuel pressure caused power loss in all four turbo compound engines. Plane had dropped to 1,500 ft. and pilot had given "stand by to ditch" orders when power gradually returned. Icing of carburetor master control was determined to have caused the lowered fuel pressure. Bendix has issued a service bulletin modifying the master control to provide for emergency fuel supply in case of icing.

► **North American F-100C is scheduled for delivery about July 1. The fighter-bomber version of the Super Sabre is equipped for in-flight refueling and has provisions for droppable external fuel tanks.**

► Lockheed's Marietta, Ga., Division is working in the field of nuclear-powered aircraft, according to R. R. Kearton, assistant general manager of the division.

► **Bristol Aeroplane Co. has secured rights to a reverse thrust device developed by Snecma.**

► Production streamlining and the learning curve has reduced the original $40 per pound cost of the Northrop F-89 all-weather interceptor to $19 a pound.

► **Initial costs for the Boeing B-52 is running about $10 million per aircraft. Overall operating costs for a B-52 wing (30 bombers) is estimated at $39,290,000 annually.**

► Convair's Ft. Worth, Tex., plant is converting a fleet of 36 C-54 transports into air rescue aircraft. Larger fuel tanks, electronic devices for navigation and search and blister-type windows for better visibility will be installed. New designation is SC-54.

► **Army has expended $15,922,000 to date on its convertiplane program. Two prototypes have been built—the Bell XV-3 and the McDonnell XV-1.**

► First Elizabethan with Napier Eland turboprops will start freight service with British European Airways in about a year. Plane is now at Napier's Luton factory being re-engined and should make its first flight in a few weeks. Elizabethans were built by Airspeed Division of de Havilland.

► **Rolls-Royce RB. 109 turboprops are being installed in the second prototype de Havilland-Airspeed Elizabethan, expected to start flight trials late in 1956. Engines are rated at more than 4,400 hp. each for takeoff.**

► An $80-million aircraft repair and overhaul program is being used by the Canadian government to distribute defense spending outside the Toronto-Montreal area where Canada's aircraft industry is concentrated.

► **RCAF Sabres in Europe equipped with the Orenda engine are out-performing USAF Sabre Jets with the GE J47-27 engine. RCAF Mk. V Sabres have higher ceiling and rate of climb than U. S. Sabres.**

► Rule die method of blanking, using inexpensive hardened steel edge set in plywood support, is being considered by Republic Aviation and North American Aviation production men for application to titanium alloy sheet, which has proven difficult to cut.

Speed for Supremacy

The immediate challenge . . . facing business leaders in every field . . . is the urgent need for expansion and modernization to maintain facilities that will be large enough and strong enough for survival in the race for industrial supremacy.

Yesterday's facilities . . . yesterday's methods of operation are outmoded unless they are adapted to the challenge of today's business competition.

In the race to capture new markets with new products and new services, business faces a line of action extending hundreds or thousands of miles from the home office. Distant plants, distant developments, far-flung interests of every sort . . . all demand the attention of executives for on-the-spot decisions.

Beechcrafts have helped thousands of expanding businesses meet the challenge of competition and of growth. Cruising at 200 miles per hour, with a range up to 1100 miles, the Beechcraft Twin-Bonanza flies *faster* and flies *farther* than any other plane in the six-place class! Hundreds of business-owned Twin-Bonanzas prove — The World Is Small When You Fly A BEECHCRAFT.

★ASK ABOUT BEECHCRAFT'S NEW EXCLUSIVE LEASING PLAN.

Beech Aircraft Corporation,
Wichita, Kansas, U. S. A.

BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

Washington Roundup

$83 Million for Airports?

There is a good chance Congress will pass legislation before adjourning providing $63 million contract authority for federal aid for airport construction annually for the next four years—$60 million for continental projects and $3 million for territorial projects. If the President doesn't veto the measure, this would give Civil Aeronautics Administration authority to enter contracts for $83 million in airport aid in Fiscal 1956. The House and Senate have already approved a $20 million appropriation for the year—almost double the Administration's request of $11 million.

The Senate Commerce Committee has already approved the $63 million authorization measure, introduced by Sen. Mike Monroney (D.-Okla.), and Senate approval is expected this week. A companion measure has been introduced in the House by Rep. Oren Harris, chairman of the Commerce Transportation Subcommittee.

Under these measures, the Appropriations committees would be obligated to appropriate funds "after" CAA had entered contracts—up to $63 million annually. Under the 1946 Airport Act, CAA has had to obtain appropriations "before" it could make contracts.

ATA Self-Enforcement

Some of the scheduled airlines are skeptical about the plan for setting up an enforcement office in the Air Transport Assn. to police their own ranks: The complaint is that they will be placed in "double jeopardy" because they are already subject to enforcement from the Civil Aeronautics Board's Office of Compliance.

However, ATA's board of directors approved "in principle" the adoption of an industry enforcement program to be put into effect Jan. 1, 1956. The Board accepted the recommendation of the airline's Air Traffic Conference that an enforcement section under a director be established within ATA. The administrative details and selection of a director, who will levy cash fines for infractions, will be worked out prior to the next ATA directors meeting in mid-December.

Navy Aircraft Restrictions

Because of the risk and unfavorable publicity that follows an aircraft crash, Navy has again tightened restrictions on public demonstration of aircraft still under development.

The new Bureau of Aeronautics instruction states that planes cannot be flown for other than experimental and developmental purposes until aircraft, its components and the pilot have 50 hours of flight time. Operating limits and maneuvers also must not exceed those established by BuAer.

No Aircraft Show "Booms"

Air Force is expected to protest, but Defense Department already has banned sonic booms and parachute drops at 1955 National Aircraft Show. This year's Labor Day event at Philadelphia International Airport also will be held with improved insurance coverage, following last year's suits over damages traced to Army's discharge of excess explosives. Residents near the Dayton Airport who filed claims have been in Washington recently pressing for settlement and received support from Defense Department lawyers, who ordered the show management to take action.

Army Dissatisfaction

Further manifestations of Army dissatisfaction with Air Force handling of its contract funds as a middleman between Army and its contractors continue to come to light.

Latest is disclosure that Navy was chosen to handle Army research and development funds allocated to a new jet-propelled convertiplane. Proposals have been boiled down to three companies—Cessna, North American and Hiller—who are expected to get contracts for design studies. Aircraft will be small, for observation purposes.

Meanwhile, several Army witnesses told Senate Appropriations Subcommittee they place high hope in the Bell XV-3 and the McDonnell XV-1. Dark horse is McDonnell HCH, a short-range, high-lift helicopter powered by tip jets.

New Washington Airport

Secretary of Commerce Sinclair Weeks is leaving it up to local residents in Maryland, Virginia, and the District of Columbia to take the initiative on construction of a new airport to ease the increasing traffic congestion at Washington National Airport.

"We have not as yet received any definite indications of active local interest," Weeks said in a letter to Chairman Warren Magnuson of the Senate Commerce Committee.

He added: "We shall be pleased to work closely with the local governments in the development of an additional facility, if they indicate an interest and a willingness to participate in such development."

Local opposition killed off the original project to construct a new airport at Burke, Va.

Cargo Plane Leasing

Precise terms and conditions under which the Navy will lease modern cargo aircraft to commercial operators, and more particularly the monthly rental rate, is expected to further reduce the number of potential applicants.

Their ranks were first thinned following the Air Coordinating Committee's approval of the Navy program subject to numerous restrictions (AW June 13, P. 135).

Two carriers most interested in obtaining Navy equipment—less than eight DC-6A's will be available—are Slick Airways and Flying Tiger Line but each has expressed concern that the price may be set too high. Slick, which had a three-month experimental lease of one plane at a monthly rental of $20,000, found its costs were increased more than 50% in meeting the Navy's requirement for a 1,400 hour overhaul.

Other potential lessees include American Airlines, United Air Lines and Seaboard & Western. All qualify under ACC's stiff rules of eligibility. Interested carriers, however, will be asked to renew or reinstate their applications for cargo aircraft with Navy, which at one time had a total of 15 companies seeking more than 45 airplanes.

—Washington staff

AVIATION WEEK VOL. 62, NO. 26
JUNE 27, 1955

AF to Speed F-101, F-104 Production

Symington scores first victory over Eisenhower as Senate approves additional Marine Corps funds.

By Katherine Johnsen

Washington, D. C.—Air Force has decided to accelerate production of two of its new supersonic fighters—the long range McDonnell F-101 and the lightweight Lockheed F-104 day fighter—and will probably request additional procurement funds soon.

The fighter decision was the second development to follow from Air Force's review of its production program undertaken as a result of disclosures of Russion air power gains by AVIATION WEEK (May 23, p. 12). A 35% increase of B-52 bomber production was announced previously, and an additional $206 million requested to accomplish this (AW June 13, p. 17).

Observers predict Defense Secretary Charles Wilson will go along with the USAF decision on accelerating fighter output, as well as a request for additional procurement funds.

Secretary of Air Force Harold Talbott disclosed the fighter decision in a letter to Sen. Dennis Chavez (D.-N. Mex.), chairman of the Senate Appropriations Subcommittee on the Armed Services and made public during Senate debate on the $31 billion defense budget for Fiscal 1956. Talbott said that he would also notify Congress of any recommendation USAF might make to Wilson in the near future for additional funds.

In the past, the procedure has been for the various service secretaries to approach Congress through the Secretary of Defense.

Will Advise Congress

Talbott stated:

"We have not completed our review of all the elements of the program financed from the appropriation 'aircraft and related procurement.' Therefore, it is not possible at this time to determine the extent to which additional funds may be needed to finance this program in Fiscal 1956. We see some possibility that all or a substantial part of the funds necessary to accelerate the fighter program can be achieved by appropriate adjustments in other areas financed by this appropriation. If additional funds are needed . . . to properly support this increase in the production of fighters and continue adequate support of other parts of the program, we will make such a recommendation to the Secretary of Defense and advise your committee of the recommendation prior to the adjournment of this session of Congress."

Talbott's decision was based on a memorandum by USAF's Chief of Staff, Gen. Nathan Twining, which dismissed possible production acceleration of two other fighters; stating:

"The production of our current supersonic fighter and fighter-bomber, the F-100, is at a satisfactory rate. . . . The production of our all-weather fighter, the F-102, is proceeding satisfactorily, but further acceleration at this time does not appear feasible."

Twining said that "it is, however, both feasible and practical to step up production on two new supersonic fighter aircraft, the F-101 and the F-104. Flight tests recently completed indicate that these advanced aircraft are ready for volume production."

Victory Over Administration

The two highlights of Senate debate on the Fiscal 1956 defense budget—passed on an 80 to 0 vote—were:

• **Air Force** was directed to obligate and expend its funds for aircraft and guided missile production "as speedily as possible" by an amendment offered by Sen. Joseph O'Mahoney (D.-Wyo.) and unanimously approved. USAF had a $5.7 billion unobligated balance for aircraft procurement on hand May 1—just two months before the close of Fiscal 1955 (see p. 25).

The O'Mahoney amendment read:

"It is the sense of the Congress that the funds . . . for aircraft and related procurement shall be obligated and expended as speedily as possible consistently with proven technological developments to the end that the United States shall not fall behind any nation in the world in air power."

• **Sen. Stuart Symington,** former secretary of the Air Force, won his first victory over President Eisenhower on a defense money showdown when the Senate approved his amendment adding $46.2 million for the Marine Corps on a 40 to 39 vote.

The $31.1 billion budget approved by the Senate is divided: USAF, $14.7 billion; Navy, $9.1 billion; Army, $7.3 billion.

The House is expected to accept two major Senate changes:

• **The $356 million** added for aircraft procurement. This includes the $150 million which the House cut from the Administration's original request and the $206 million additional requested, after the House had passed the budget bill, to accelerate B-52 production. The House cut was made solely because it developed that USAF's carry-over of unobligated funds would be larger than anticipated when the procurement estimate was calculated. With the speed-up of fighter and bomber production, the situation has now changed.

• **The $210 million** additional made available for research and development. The Senate added $10 million to the $25 million approved by the House for the "emergency fund" of the Secretary of Defense, and authorized the transfer of up to $200 million to the fund from other programs. Assistant Secretary of Defense for Research and Development, Donald Quarles, said the fund would be used for special research and development projects that might develop during the year.

The $6.3 billion approved by the Senate for aircraft and related procurement is more than double the Fiscal 1955 appropriation of $2.7 billion.

Aviation Week's Role

Other appropriations approved by both House and Senate, as recommended by the Eisenhower Administration, were:

• **Naval aircraft** and related procurement, $905 million—$1 billion below the Fiscal 1955 allocation. Navy Secretary Charles Thomas has testified that procurement requests would increase sharply, starting in Fiscal 1957 (AW Feb. 21, p. 44).

• **Air Force research and development,** $570 million—$152 million more than the Fiscal 1955 allocation.

• **Naval aviation research and development,** $165 million—$7 million less than Fiscal 1955.

Protesting that "we have been coasting down, to save money, every day until the recent incredible display of air power by the Soviet last month," Symington, during debate on the defense bill, complained:

"The request for more money to

TO THE WOODS, MEN! Army H-21C Workhorse helicopters evacuate high military officials from the Pentagon to secret headquarters at start of Operation Alert. Twelve of the 20-passenger Piasecki copters were used to move high military and civilian dignitaries from Washington and vicinity during the three-day civil defense test. The helicopters also were utilized for courier service.

speed up the production of the long-range B-52s was made by the Department of Defense only after Senate committees demanded the facts, and an authoritative magazine (AVIATION WEEK) had released available details about the Moscow flights."

Fail To Release Photos

Although "everybody in Moscow" had the opportunity to see these flights, Symington observed, "even as of today, the photographs of these planes have never been declassified and released to the American people."

Of the five chief categories of air power—fighters, light bombers, medium bombers, heavy bombers, and missiles, Symington declared "the Soviet is ahead in two, probably ahead in two more. The United States is ahead in one."

He commented that we are now told by the Department of Defense that the Soviets are substantially ahead in numbers of operational modern jet fighters and modern light jet bombers.

"Latest knowledge would tend to show that the Communists have passed us in the production of modern long range jet intercontinental bombers," Symington said. "Any extrapolation based on facts convinces us the Communists are ahead in the missile field—well ahead with the intercontinental ballistic missile, the ultimate weapon, at least in our time." Only in medium bombers is the U. S. substantially superior to the Soviet, he said.

Sen. Smith's Views

Pointing out that the number of Defense secretaries has grown from four, when the services were unified in 1947, to 31, Symington called the Pentagon a "bureaucratic empire unparalleled in the history of our government." He said that "if this administrative monstrosity were cleaned up at the top by true unification . . . billions of dollars annually would be saved the American taxpayer."

Sen. Margaret Chase Smith (R.-Me.) challenged Symington when he criticized the President for supporting a reduced Air Force goal of 48 groups, instead of the original goal of 70 groups, three months before the outbreak of the Korean war in mid-1950.

Commenting that Symington was "indulging in the luxury of hindsight," Mrs. Smith observed that although Symington "initially took a strong stand for a 70-group Air Force at that time in his capacity as Secretary of the Air Force, I do not recall that he continued to publicly maintain that stand."

Symington replied that "when it became obvious the Air Force was to be composed of only 48 groups, I resigned . . . and quietly gave that out as the reason for my resignation."

Now It's Defense News Only If It's 'Useful, Valuable or Interesting'

By Claude Witze

Washington, D. C.—New formulas to help Defense Department officials withhold unclassified information from the public are being promulgated from the Pentagon.

One of them is a "guide" that asks military news sources to evaluate "anything you can think of" in deciding whether to supply the answer to a question. Public information officers say frankly that the system will make them withhold replies to most news requests to be on the safe side.

Source of the standards is R. Karl Honaman, Deputy Assistant Secretary of Defense for Public Affairs, who was shifted to the Pentagon about a month ago from the Office of Strategic Information at the Commerce Department. His latest steps in carrying out Defense Secretary Charles E. Wilson's order to tighten release of public information:

- **Disclosure of a new** department standard stating that information must not be given out unless it meets the test of being "useful" or "valuable" or at least "interesting."
- **An experiment with the Army,** under which commanders have been supplied with pads of a form, "Balance Sheet for Strategic Information," a type of score board where checks in some of 20 boxes can be tallied at a glance to help the judgment of a public information officer.

The "balance sheet" bears the imprint of the Commerce Department and evidently is a system drafted by Honaman's office before he moved to his Pentagon post. It calls upon a military public information officer, whose service training has taught him to answer all queries within the limits of military security, to grade the news.

The information officer is asked to weigh whether he thinks it will be "helpful" or "harmful" to the United States and in each case by degree—"much" or "little."

There are five items under which a piece of requested information must be graded:

- **Net effect on military power**
- **Net effect on industrial power**
- **Effect on morale**
- **Other strategic angles**
- **Other considerations.** It is here that the information officer is given carte blanche to enter "anything you can think of." Then he is to decide how much help or harm will be done to the nation's interest by dissemination of the data in the light of "anything you can think of."

As a precautionary measure, he is warned to make his decision "in net balance, all things considered."

Order 'Casts Doubt'

Other items on which a public information officer is called to pass judgment include such elusive factors as world opinion, the morale of a hostile nation, the ability of the U. S. and an

enemy to fight a war, improve the economic foundation and commit acts of sabotage.

Honaman's utilization of the "useful" standard came to light in an exchange of letters between him and J. R. Wiggins, managing editor of the Washington Post and Times Herald. Wiggins is chairman of the Freedom of Information Committee of the American Society of Newspaper Editors.

The editor challenged Honaman's program to set up a new "grey area" of data that is unclassified but which he thinks may help an enemy. Wiggins said that Secretary Wilson's order "has cast doubt upon all information . . . from the Defense Establishment."

Tests To Meet

In reply, the deputy assistant secretary denied the intention is to "limit the availability of information to that which is self-serving." He said the public is eager for certain facts and needs them to "play their part as citizens."

He added:

"There are, nevertheless, many cases where demands for information which take up the time of people with busy schedules do not truly meet the requirement of being useful or valuable, nor yet very interesting to the public. These are tests that should be met."

Wiggins came back with the observation that "an official inside the Defense Department is not likely to regard as constructive, information that discloses his own errors. Persons on the outside of the Department may very well regard these disclosures as constructive and public serving."

The editor also declared that the nature of a democracy requires a continuous flow of information from the government to the people, not only of facts the citizens get "contrary to the wishes of government."

Anything else, Wiggins said, "is an indefensible philosophy in a free society."

Newsmen Complain

In the past few weeks, growing concern over Administration efforts to stifle the flow of news has resulted in a rising tide of complaints from Washington reporters. Veteran newsmen on practically all beats outside of Congress and the Supreme Court are complaining of the difficulty in getting news and the inaccessibility of policy-making officials.

There also are instances of high-ranking personnel who are less than honest in answering queries. One Washington correspondent of many years experience says, "A Cabinet officer has lied to me on two recent occasions. It never happened before. Somehow, these men see no reason why they should not lie to a newspaperman."

Copies of Honaman's "balance sheet" were supplied to Army commanders with a letter from Brig. Gen. T. S. Briggs, Deputy Chief of Information. He told the commanders they were to serve as a guide in answering press and other inquiries.

An Army spokesman told AVIATION WEEK the sheets were sent out as an experiment at Honaman's request "to see how they would work in the field." He added that he did not think they were necessary for experienced public information officers, "But we thought they might prove helpful to some of the greener men."

Pentagon public information officers refused to use the form, saying they could not judge such matters.

A Commerce Department spokesman said the "balance sheet" was prepared "in consultation with principal trade and business publications." Efforts to find a publisher or publishing group that was consulted were unsuccessful.

Aircraft Industry Cuts Costs, Says Allen, Refuting Subsidy Charge

Seattle—U. S. aircraft industry is making "great strides" in reducing and controlling the cost of military plane production, William B. Allen, president of Boeing Airplane Co., said last week.

In Boeing plants alone, efforts to improve efficiency and cut expenses saved the government nearly $100 million during the past several years, he told the Washington State Bankers Assn. The cut-costs program returned an additional profit to Boeing of less than $10 million.

Profits, Competition

Allen attacked statements that the aircraft industry is making too much money and lacks competition. His answers to these charges included the following:

• **Aircraft profits.** "In 1954 our (Boeing's) earnings represented 3.58% of sales. For a number of years prior to that, when the excess profits tax was in effect, our return was approximately 2% of sale. These figures are fairly representative of the aircraft industry. This compares with an average return of 6-7% on net sales for all manufacturing industry in the United States . . .

"In only three of the nine years since the end of World War II has the aircraft industry made a return on net worth greater than that realized by all manufacturing industry, and the average for the aircraft industry for this nine-year period is below the average for all manufacturing industry.

"The three years during which Boeing and the industry experienced a high return on net worth are 1952, 1953 and 1954, during which time the industry was building to a peak. Present military programming indicates the volume of business for the industry will now decline from this peak, with the result that the percentage of return on net worth will materially decline because of lower total profits applied to a higher net worth figure due to retained earnings."

• **Industry competition.** "I make the unqualified statement that the aircraft manufacturing industry is highly competitive . . . the B-52, for example, was designed and developed over a number of years. During that period it had strong competition—in fact, the project was close to death on a number of occasions.

"I assure you the B-52 has had a very competitive life and, as it has in the past, will in the future be challenged by the products of our competitors."

Subsidy Critics

Boeing's president also struck at industry critics who claim it is subsidized because the government furnishes some plants and machinery for aircraft production.

He also stated the inability of aircraft companies to provide all facilities needed for production largely is due to these two factors:

• **Large fluctuations** brought on by wars or international tensions that require production far beyond normal needs.

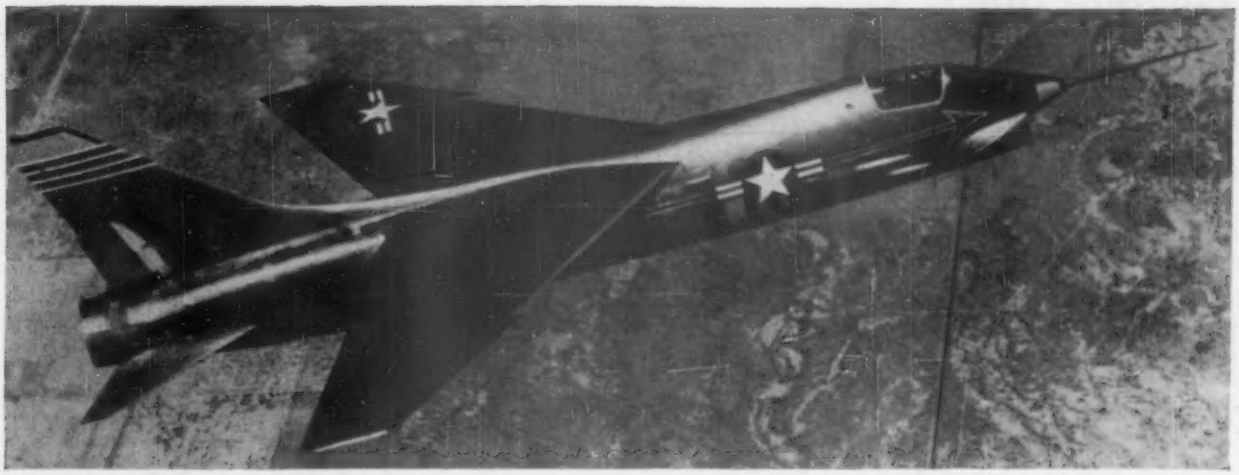
• **Industry earnings** over the years have not enabled it to provide itself with necessary equipment and plants to meet these demands.

Pilot Blamed in Crash

Crash of an Alaska Coastal Airlines plane was probably the result of loss of control while the pilot was attempting to operate visual flight at less than required altitude and weather minimums, Civil Aeronautics Board reports.

The crash occurred while the pilot was negotiating a mountain pass between Pelican City and Hoonah in poor weather. The pilot died of injuries, and two passengers were seriously injured. The airplane, a Grumman G-44 amphibian, was destroyed.

Postwar 6 Mos. Current RAF total costs, including all overheads,



WING SWEEP BACK AND HIGH MOUNTING are shown on this photo taken during XF8U-1 flight test at Edwards AFB.

Supersonic XF8U-1 Details Revealed

Design features that fit Chance Vought's XF8U-1 for its role in carrier-based airpower are revealed in the first pictures released of the Navy's supersonic day fighter.

The Navy asked for high rate of climb, extreme altitude capability and level-flight supersonic speed.

Vought designers combined the low-drag characteristics of a very thin, swept wing with the high thrust of a Pratt & Whitney J57-P-4 with afterburner in a lightweight airframe of simple design.

Aerodynamic Design

The high mounted wing sweeps back approximately 40 deg. and has a small amount of negative dihedral. Thickness ratio is very low, on the order of five percent at the tip. The outboard panel of the wing has a leading-edge extension: the entire leading edge of the wing appears to act as a droop snoot flap.

Trailing-edge surfaces have been blocked out in the photographs. There are two possibilities: either midspan ailerons are used, or spoilers handle the lateral control.

The slab tail is low-set to counter pitch-up instability at high Mach numbers. Height of the vertical tail should provide ample directional control during high angle-of-attack maneuvers at high speed and altitude.

Powerplant Details

Tip of the vertical fin is a reinforced plastic housing for antennas; its leading edge is coated with erosion-resistant material.

A sharp-edged, jowl inlet for the Pratt & Whitney J57-P-4 turbojet is hung just under nose of the XF8U-1. Air ducting runs under the pilot's floor to the engine, mounted above the main landing gear well.

Fuel tanks are in the fuselage ahead of the engine; there is no room in the thin wing for fuel storage.

Parts of the rear and middle fuselage are made of titanium alloy for high-temperature strength and lightness.

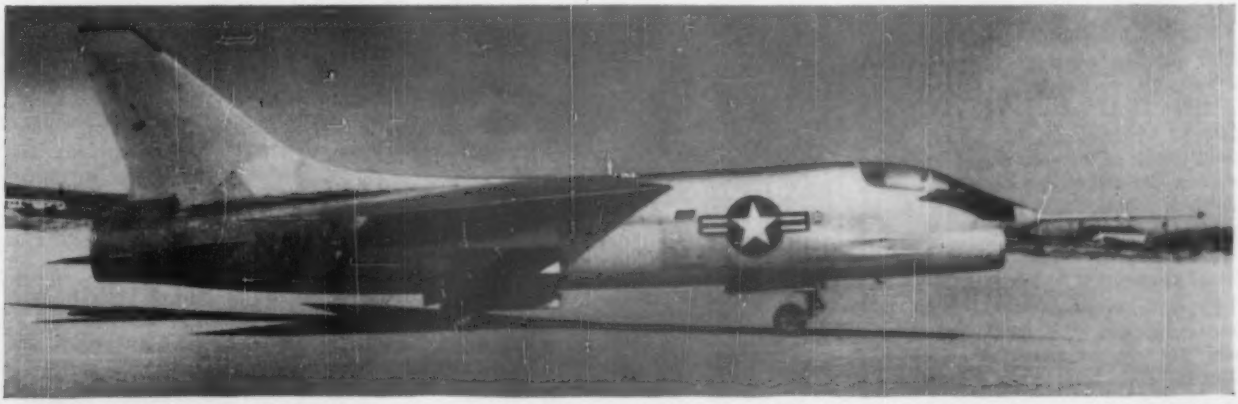
General shape of the fuselage is slab-sided with gently rounded top and bottom. Canopy top line breaks above the fuselage only slightly, then drops sharply away for downward visibility over the nose in carrier landings.

Four cannon—presumably the standard Navy armament of 20-mm. guns—are mounted below and behind the pilot's floor. Cockpit layout and design follows current Navy practice. The ejection seat is the lightweight Chance Vought model (AW, Apr. 18, p. 96), adapted from the original Douglas Aircraft Co. designs.

Overall length of the XF8U-1 is about 58 ft., and height to the tip of the vertical fin is about 18 ft. Maximum fuselage depth is seven feet; the wingtips clear the ground by six feet.

One major factor in the fighter's development was an extensive wind tunnel program, done by NACA, the Navy and the manufacturer. Payoff came on the first flight when the XF8U went through the Mach one mark in level flight, as revealed in AVIATION WEEK Apr. 25, p. 90.

Flight tests have been made at Air Force Flight Test Center, Edwards AFB, under Vought test pilot John Konrad.



EXTREME THINNESS OF WING and low setting of slab tail show up in this view. XF8U-1 length is about 58 ft., overall height is 18 ft.

Destroying 6 More Comets, RAE Tells Aeronautical Conference

Los Angeles—Six de Havilland Comet 1A's will be tested to destruction in the water tanks of England's Royal Aircraft Establishment, bringing to eight the Comets to be tested for pressurization failure.

This was disclosed by Percy B. Walker, head of the RAE Structures Department, at last week's Fifth International Aeronautical Conference, a joint meeting here of the Institute of the Aeronautical Sciences and the Royal Aeronautical Society.

Walker, in the liveliest session of the conference, said water testing of a Bristol Britannia already has started at Farnborough. Vickers is building a tank to water test the Viscount, he said, and de Havilland will conduct its own water test of the Comet IV.

Masefield Protests

These plans for wholesale destruction of British transport aircraft brought a protest from the chief executive of British European Airways, Peter G. Masefield, who expressed the hope that the Farnborough water tank could soon be retired "to the RAE Angling Society."

"The Comet was obviously too thin and not strong enough," Masefield declared. He suggested that the Comet accidents were causing the British to be over-cautious about fatigue of aircraft pressure cabins. A 50,000 hr. fatigue life will be a satisfactory goal, Masefield said, and after that the water tank should be retired.

"Can you think of any better purpose we could put these Comets to?" asked Walker in reply. He said the use of the Comet fuselages will provide a never-to-be equalled opportunity to determine averages on pressure failures.

Jet transport designers from Lockheed, Douglas, Convair and Boeing refused the opportunity for public debate on the cabin failure program and stayed out of the discussions, leaving the floor largely to the British.

American Reply

The U. S. answer came from Richard V. Rhode, assistant research director of the National Advisory Committee for Aeronautics. Rhode reported on NACA tests which indicate that allowing cabin ribs and stringers to carry most of the strain of pressurization will reduce the possibility of explosive decompression, and allow the discovery of fatigue cracks before they become dangerous.

This differed from the British solution presented by the RAE's Walker, who emphasized the part the fuselage skin itself can play in eliminating the hazard of explosive decompression.

The joint meeting, held for the first time in California, was a highlight of a two week visit by more than 100 British engineers and executives to exchange ideas with American designers.

Viscount Success on BEA

Chief Executive Masefield of BEA led off when he pointed out to a meeting buzzing with news of forthcoming Lockheed and Douglas turbine aircraft that British European Airways made the world's first commercial turbine-powered passenger flight five years ago—with the Vickers Viscount prototype.

Since then, Masefield pointed out, BEA has flown a total of 57,000 aircraft hours and 225,000 engine hours with Rolls-Royce Dart engines installed in 30 aircraft.

The scheduled BEA Viscount service has earned a net profit of $2,789,100 at the rate of $54 a flying hour and $.24 profit for every mile flown. Break-even load factor has averaged 34.5% on direct aircraft costs and 60.4% on total costs, including all overheads, interest on capital and other finance charges.

These figures were established over an average sector distance of 490 mi. at an average block speed of 223 mph.

"Over all these routes," Masefield asserted. "The Viscount has materially improved BEA's competitive position and has dramatically increased the ratio of traffic carried by BEA against such excellent aircraft as the DC-6B and Convair, operated by rival airlines."

If it sounded like a strong British sales pitch for the Viscount in the face of recent announcement of the Lockheed Electra, there was no one around to argue with it—on the official program, at least.

Production Lines Talk

U. S. industry let its production lines do the talking. British delegates toured aircraft plants in the Los Angeles and San Diego areas, visited the Air Force Flight Test Center at Edwards AFB, and inspected NCAA's Ames Laboratory at Moffett Field.

As one British delegate said, "It isn't Farnborough but it is rather impressive."

Other highlights came from papers by:

• **Bartram Kelley**, chief engineer of Bell Aircraft Corp., Texas Division, outlined Bell plans for a wing-shaped tailless helicopter lifted by twin rotors. He discussed model tests of this configuration which, combined with boundary layer control, show some promise. The whirling arm test rig has indicated that rotor downwash will have a stabilizing effect on this "flying wing" configuration, reducing sensitivity to gusts, Kelley reported.

• **Edward H. Heinemann**, chief engineer of Douglas Aircraft Co., El Segundo Division, discussed some of the problems encountered in designing high speed aircraft. Heinemann, in addition to general comments on buffeting, pitchup and instability, made some interesting remarks on specific Douglas aircraft. Use of a lower horizontal tail on the A3D would have improved its stability at the stall, he said, but this was avoided because of the unknowns involved in locating a tail in the jet engine exhaust.

While the lightweight A4D is stable without slats, slats were employed because of the "very large gain" in maximum lift coefficient. Slats on the F4D Skyray are to improve low speed lateral flight characteristics, he said. Douglas found vortex generators to be most effective means of curing both buffeting and wing dropping on the A4D. Yaw dampers on the A3D and F4D brought flight characteristics on those two aircraft from unsatisfactory to satisfactory, according to Heinemann.

This report of the Fifth International Aeronautical Conference was prepared by Aviation Week's West Coast Editor William Coughlin and Senior Engineering Editor Irving Stone.

'Most Precious Element'

Los Angeles—The aircraft industry must make better use of its engineers, Lockheed President Robert Gross told the opening session of the Fifth International Aeronautical Conference.

"Time and urgency and realism being what they are, we must resign ourselves to the fact that we are not going to get many more new engineers now," Gross said.

He termed engineering capability "the most precious element" in the whole aeronautical apparatus.

"If we could get a better, simpler, a different approach by our military and naval friends to the problems of developing new [aircraft] types we might astound ourselves now and then as to what could be done," Gross said.

President Norbert E. Rowe of the Royal Aeronautical Society told the opening session that aeronautics is a key to peace. He said it is more capable of achieving revolutionary developments than any other force in the world today.

French Fly Rocket, Ramjet Fighters

By William A. Waterton

Paris—The last two days of the 21st Paris Salon d' Aeronautique were devoted to showing in action in the air what had been displayed earlier on the ground. It was a memorable flying show with hot blazing summer sun on Saturday and low cloud with some rain during Sunday.

The French flying was not the tightly-integrated, closely-controlled type of show seen at Farnborough in England, but it was certainly the most interesting air display seen in post-war Europe.

Top of the novelty bill was the futuristic pot-bellied Leduc 0.21, the flying duct with the needle nose and "see-right-through-it" engine. Its performance dispelled any doubts as to whether it would work. From its perch atop the Languedoc mother plane, it rose clear at 6,000 ft. over the center of the aerodrome, it wheeled to port and, within a quarter mile of its release, the firing of the propulsive duct could be seen.

Maintaining altitude, the Leduc rapidly built up speed to what appeared to be around the 600 mph. mark.

It appeared to be very maneuverable and left no trail of fire. Only an orange colored flame could be seen burning in the rear fuselage.

After several passes, Pilot Littolff stopped and relit the fire. He demonstrated his confidence in the Leduc by carrying out two circuits of the airfield at well under 1,000 ft. The lightened Leduc glided in to a very slow landing. About 20 ft. above the runway it streamed a ribbon-type braking chute. After touchdown it pulled up extremely short.

Swept-Wing Leduc 0.22

Rene Leduc has been working on propulsive ducts for years, showing an early model of this aircraft at the Paris Salon of 1938.

The Leduc 0.21 is experimental, but later this year it will be followed by a swept-wing fighter prototype called the Leduc 0.22.

This machine will be able to take off and fly on a single Atar jet engine mounted at the centre of the concentric rings of burners within the fuselage. This will enable it to cruise on the economy of a jet engine and at the same time build up the speed necessary to make the tuyeres work initially.

This huge afterburner will then give the terrific thrusts required to drive the plane well toward Mach 2 in climb and chase.

Colossal Rocket Climb

Speaking of climb, the rockets demonstrated that they had it. The small experimental Trident, prototype of an interceptor day fighter, hissed down the runway on its two wingtip mounted Viper engines and one of its three Sepr rocket barrels. The rocket barrel lit up at the beginning of the run and burned with a white flame that streamed some eight or 10 ft. behind the Trident.

Trident Tailplane

The Trident has a tailplane with considerable anhedral and little ground clearance at the rear. Consequently little incidence was used on takeoff or landing. The landing was done with a braking chute.

Both takeoff and landing were long and at what appeared to be high speed. Once over the disappointment of the long takeoff, the Trident redeemed itself by rapidly gathering speed and literally going upstairs like the rocket it is. Its course upwards was marked by a light trail of brownish smoke with a blob of white fire at its front.

It rate of climb was colossal. Two whitish puffs of white at an estimated 8,000 ft. were taken by many to signify the passing of Mach 1. It would be difficult to say but they looked more like puffs from the extinguished rocket for there was rocket motor trouble.

The Trident was back over the aerodrome shortly thereafter and did not fly on Sunday. It left no doubt, however, that rockets will make a plane move. Neither did its successor on the next day.

Fire Breathing Series

The Trident replacement was its predecessor, the Espadon—a conventional single-engined low-wing monoplane with a rocket discharge orifice under the rear fuselage some six feet or more ahead of the F-80 type jet pipe. Again there was a light up at the start of the run with the white flame and very high speed even from the single rocket. Again exceptional rates of climb were shown.

The rocket motor was cut in and out no less than five times, with white flashes on light up and puffs of brownish smoke on extinction. With what this one motor did for the Espadon at low altitude, there can be no doubt of the French claims for the Trident when two or all three barrels are blasting together.

Fourth in the fire breathing series was a night fighter Meteor Mark 11 carrying a normal fuel drop tank below its port wing and a small diameter parallel sided ramjet in place of the starboard underwing tank.

The Mark 11 flew round for long periods with an 8 to 10 ft. stream of orange colored ramjet flame emiting from the tube.

Neither rockets nor ramjets were unduly noisy and all seemed to be well under the control of their pilots.

France without a doubt has more practical experience with manned rockets then anyone else in post-war Europe. An indication of what can be expected is the fact that already the Tridents total combined thrust exceeds its weight which is the formula for true sustained vertical rising performance.

Brake Chutes, Skid Landings

Dropping the Buck Rogers stuff, the small delta Gerfaut fighter prototype got off the ground on its single Atar turbojet after a remarkably short run and climbed with surprising rapidity. It looked extremely fast, rolled very rapidly as deltas do and appeared to barrel out of its rolls, also a delta tendency.

Pilot Turcat brought the Gerfaut in fast with little incidence. The ribbon-type chute stopped it in a surprisingly short distance.

The braking chute appears to be as well established and as much a part of the scheme of things in France as in America. It is used both experimen-

New British Data

Britons at the Paris air show flying display were surprised to hear the announcer on the public address system give performance figures in French and English on the latest two V-bomber types.

The RAF Handley Page Victor and the Avro Vulcan which flew over from England for the show were announced as doing 594 mph. at 59,000 ft. which is Mach 9.

Honors for short takeoffs and steep climbs were shared between an English Electric Canberra and a Gloster Javelin.

The Canberra's aerobatics and spins were exceptional. The Royal Air Force Hunter aerobatic team emitted peculiar noises from the Avons compressor bleed valve as they maneuvered.

Safety Emphasized

The Paris flying display operated under the tragic shadow of the auto race accident at Le Mans the previous weekend which killed 82 people and injured another 150 when a racing car plunged into the spectators and exploded.

French public opinion ran high after the Le Mans tragedy and government officials seriously considered canceling the flying display. The show went on with 50 ambulances, 250 doctors, blood banks, special marked casualty excavation routes and thousands of police to control the crowd of 100,000 spectators.

Pilot briefings were strict with many safety precautions imposed on planned maneuvers. The pilots, particularly the French, were obviously holding back to stay far within safety restrictions imposed during briefing.

tally and on service aircraft such as the Vautour.

As demonstrated by a Mistral—French-developed Vampire—and two Baroudeurs, the skid-landing technique seemed quite normal. The planes put down on rough grass and dirt alongside the runway. The Baroudeurs streamed tail chutes to stop in what appeared to be about 1,500 ft. They ran true and within 3 min. of touchdown, were taxiing away on the trolleys onto which they had been hauled and engaged by the quick-connect brake and release line.

Trolley takeoffs, leaving the latter on the ground and also carrying it aloft, were demonstrated to show that the scheme was out of the idea stage and a working proposition.

In flight the plane demonstrated transonic capabilities and the high performance one expects of its configuration.

Ambitious Aerobatics

Various marks of Mysteres were shown together with their old relative the straight-winged Ouragan. Four of the latter, mounting wingtip tanks, comprise the aerobatic team of the French Air Force. In steadiness of formation flying, this group rivaled the USAF's peerless F-86-mounted Skyblazers, although the French maneuvers were not as ambitious.

An operational squadron of centrifugal Tay-Verdun-powered Mystere Mark 4s passed over. Going into squadron service on Mysteres is the Snecma thrust reverser, licensed in the U.S. and Britain. This thrust deviator was convincingly demonstrated on a Mystere Mark 2, which after landing short proceeded to back up on a runway that sloped up behind the plant.

Another version of the Mystere, this time a Mark 4 two-seater night fighter, took off for Tunis 940 mi. away, carrying the French minister for communications. This fighter looks much like an F-86D Sabre. It carries 30-mm. cannon and rockets and is understood to have endurance exceeding 3 hr. on the 1,300 gal. of fuel it carries internally.

Strong NAA Influence

The North American Aviation Inc. influence is strong in all the Dassault designs, culminating in the Super Mystere with its sloping nose and flattened nose intake. It also sports a slab tailplane mounted on the fin.

A 10,000-lb.-thrust afterburning Avon turbojet is said to give it level supersonic speed, although its demonstration at Le Bourget was somewhat disappointing. It looked slower than the Hunter, which was flying much lower and making a great deal of noise at a reported Mach .94.

The Super Mystere was said to be doing but 550 knots and arrived somewhat after its rather feeble bang. The Mystere Mark 4B arrived ahead of its supersonic bang.

All the Mystere series showed the earmarks of good practical aeroplanes. They took off and landed reasonably short, climbed well and seemed really steady in the air. Their rates of roll were universally good. Aileron control seemed precise and accurate.

Fast-Climbing Vautours

Four all-weather and bomber twin-engined Vautours took the air from their B-47-type bicycle landing gear, getting off smoothly and climbing well. It was announced that the Vautour reaches altitudes just under 40,000 ft. in under 6 min., which can give the interceptors something to think about. Some were fitted with Atar turbojets, others with Sapphires—the latter giving out their lowing cow note familiar to those who have been near the Thunderstreaks.

The Vautour is credited with 720-mph. level speed but seemed slow to the eye. At 40,000 lb. maximum weight, the Vautour rolled fast for a plane of its size and gave very audible warning of its supersonics to groundlings.

The fighter versions carry a pair of 30 or 37-mm. cannon, rockets and guided missiles. The bomber will carry atomic bombs. It was seen to have rotary bomb doors and carried four bombs of what appeared to be 1,100 lb. each.

Using chutes, the landing distances were moderate.

Caravelle Fly-By

The Caravelle brought the house down as France's first jet transport. It is to carry 70 to 90 passengers, with a still air maximum range of 2,300 mi. This range is ideally suited for longer European and North African routes out of Paris.

In flight, the plane resembles the 17th century trading galleon whose name it takes. Its great fin and rudder endow it with a high pooped appearance.

With 20 flights and 15 hr. under its belt, it did not land at Le Bourget but demonstrated steep turns, medium-speed and very-slow-speed flight most effectively.

It uses the snake-headed Comet nose section and carries much of its fuselage in front of its moderately swept wings. Fuselage gage is much heavier and stringer spacing is understood to be half that of Comet. Two 10,000-lb.-thrust Avon turbojets on stub wings from the rear fuselage give the Caravelle an extremely clean head-on appearance.

The flaps seem to be of narrow chord and are huge in span, extending right out of the ailerons.

The transport handled well and should be ideal for French routes.

Light Jet Brigade

Most intriguing was the performance of two Hurel-Dubois Model 32 high-aspect-ratio wing Dakota replacements, ordered by Air France and the French Navy. They took off in some 1,500 ft. or less and turned tightly within a small part of the Aerodrome area. Landings were as short as takeoffs.

Among the light brigade, the small jets were impressive—including the Sipa, the Magister aerobatic team of four and a Fleuret that was chucked about the sky with great elan.

The heavier, full fighter-size Fokker S-14 was magnificently flown by Sodermann, who did a long spin down from the top of a vertical climb.

The Fiat F-82 also flew well, doing aileron turns down from a vertical climb.

Quite unique among the small stuff was the 16-ft. delta Payen pushed by a single 350-lb. thrust Turbomeca Palas at over 300 mph. Its pilot sits in the base of the Fin. The Payen is to be followed by a Viper or Twin Marbore version.

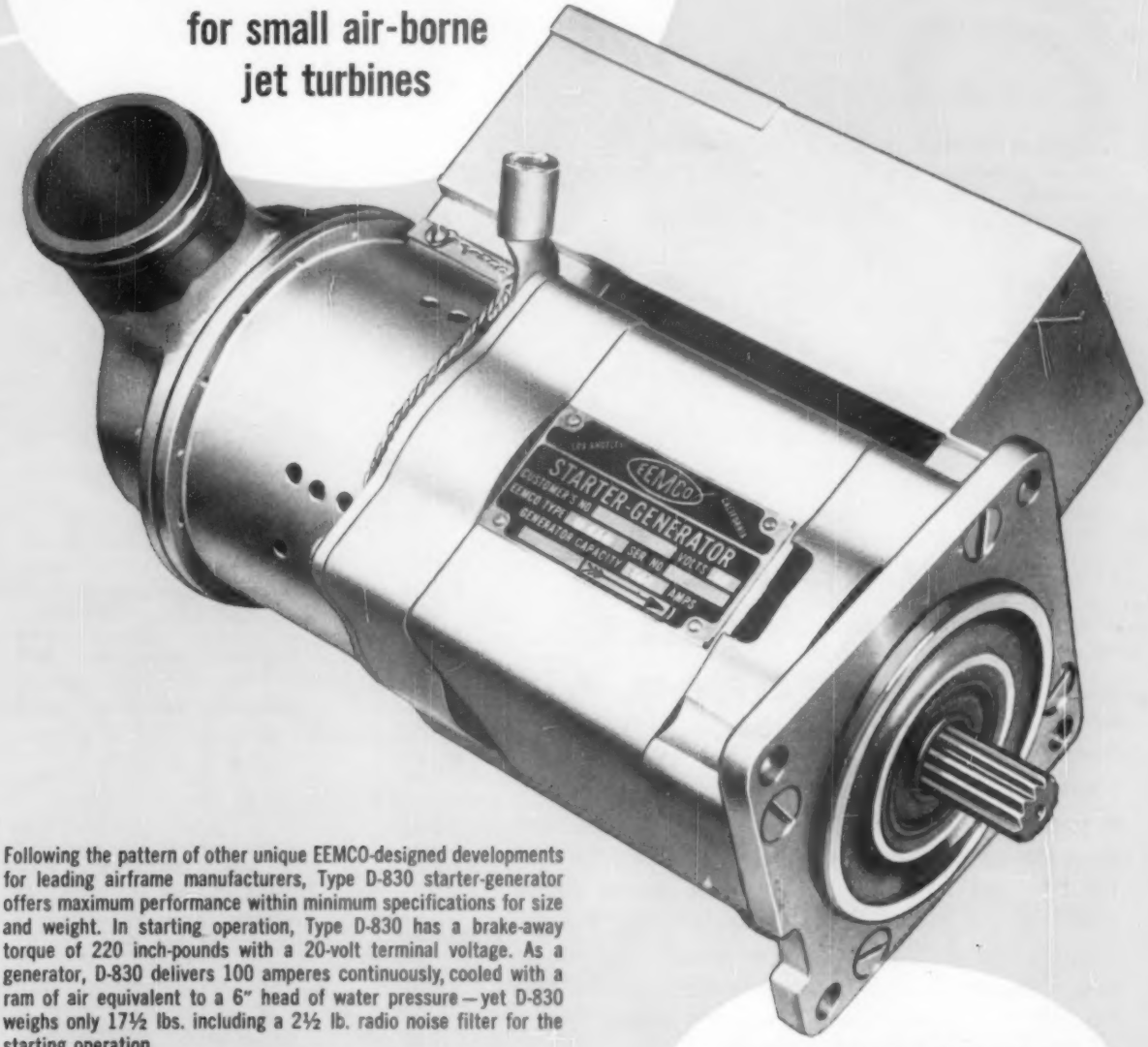
French pilots do not seem to employ much incidence in landing the Payen and, like the Gerfaut, it looked hot on the approach. The turbine-powered Alouette was the most impressive of the numerous helicopters by virtue of carrying a small Citroen van round the aerodrome.

(This is the second of three special reports to Aviation Week on the 21st Paris Salon Aeronautique by William A. Waterton, famous British test pilot and air correspondent of the London Daily Express.)

technical bulletin

a New

High-output, Light-weight
STARTER-GENERATOR
for small air-borne jet turbines



Following the pattern of other unique EEMCO-designed developments for leading airframe manufacturers, Type D-830 starter-generator offers maximum performance within minimum specifications for size and weight. In starting operation, Type D-830 has a brake-away torque of 220 inch-pounds with a 20-volt terminal voltage. As a generator, D-830 delivers 100 amperes continuously, cooled with a ram of air equivalent to a 6" head of water pressure—yet D-830 weighs only 17½ lbs. including a 2½ lb. radio noise filter for the starting operation.

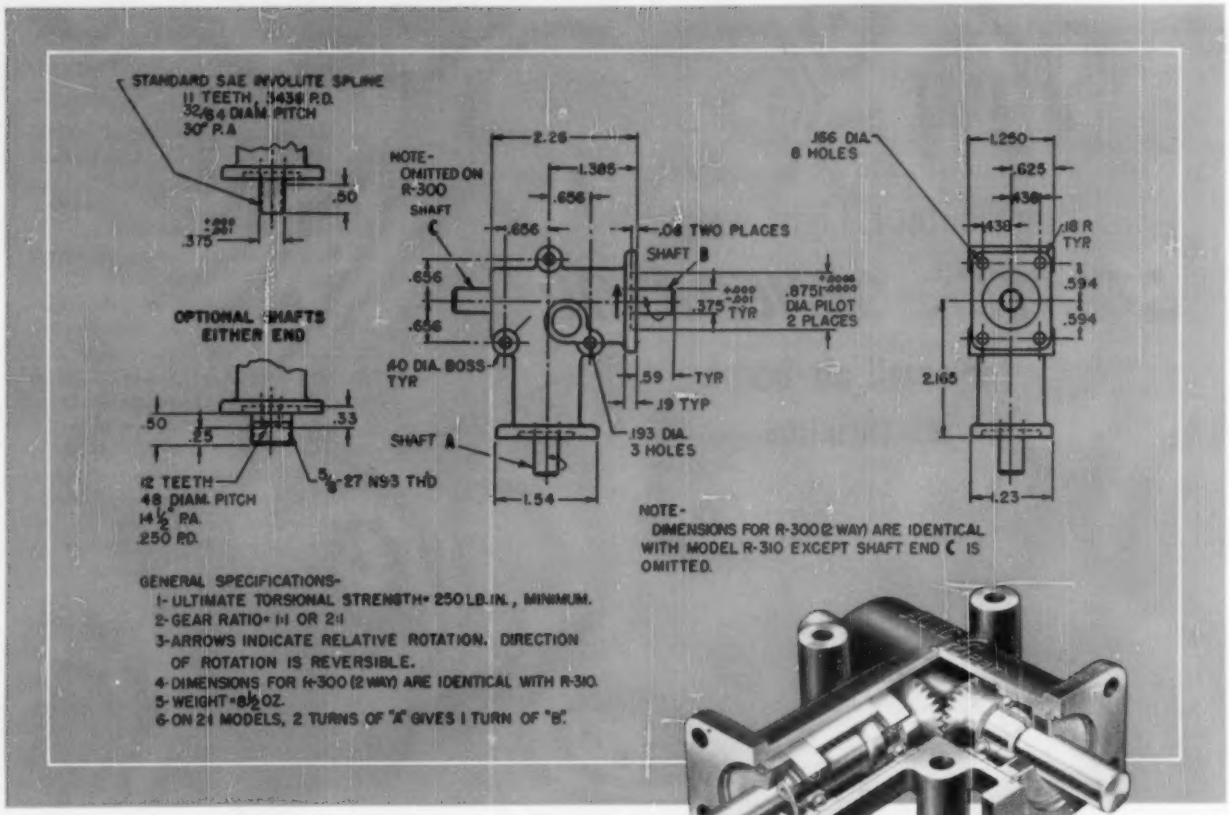
The high output of EEMCO Type D-830 starter-generator in relation to its weight is typical of the many products designed, developed and produced by EEMCO for leading airframe manufacturers. Constant search for new materials and methods has resulted in production of highly efficient actuators, motors and starter-generators that meet specifications for all late designs of supersonic aircraft and guided missiles.

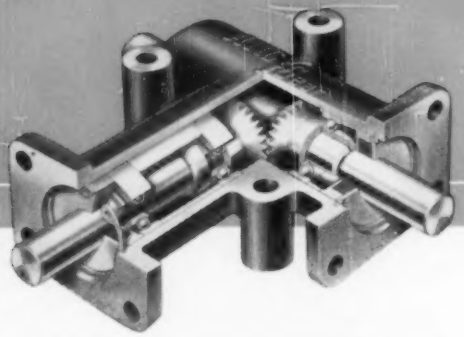
PROJECT ENGINEERS are invited to review the specifications of these proven EEMCO precision products before ordering new designs. Substantial savings in development time and cost can often be effected by adapting a tested EEMCO product with but minor changes to meet new conditions. Your inquiry is invited.

Electrical Engineering and Manufacturing Corp.

4612 West Jefferson Boulevard
Los Angeles 16, California
Telephone REpublic 3-0151

Designers and producers of motors, linear and rotary actuators





HOW TO MAKE A RIGHT-ANGLE BEVEL GEAR

Need a right-angle gear drive? You can make one yourself. Here's all you need: a set of Coniflex* gears, a precision-cast housing, antifriction bearings, and shaft extensions. Put these together, lubricate the unit for life, test it for quietness (noise means future trouble), and you have a right-angle drive. Too expensive, you say? That's why we would urge you to buy ANGLgear, a compact, standardized take-off that has won the respect of designers everywhere.

**Trade-mark The Gleason Works, Rochester, N.Y.*

Model & Type	Ratio Turns "A" to Turns "B"	HP Output	RPM Shaft "B"	Ultimate Static Torque (lb in)	Shaft dia (Inches)	WT (lb)
R-300 2-way	1:1	⅓	1800	450	⅜	½
R-300-2 2-way	2:1	⅓	1800	450	⅜	½
R-310 3-way	1:1	⅓	1800	450	⅜	½
R-310-2 3-way	2:1	⅓	1800	450	⅜	½
R-320 2-way	1:1	1	1800	1500	⅝	2.2
R-320-2 2-way	2:1	1	1800	1500	⅝	2.2
R-330 3-way	1:1	1	1800	1500	⅝	2.4
R-330-2 3-way	2:1	1	1800	1500	⅝	2.4

LINEATOR® • ROTORAC® • TRIM TROL® • ROTORETTE® • ANGLGEAR • ROTOLOK

AIRBORNE

ACCESSORIES CORPORATION

HILLSIDE 5, NEW JERSEY

NEW AIRBORNE CATALOG

Contains full information on the Airborne line of electromechanical actuators and feel systems. Write for your copy today.

XC-99 Starts Record 300,000-Lb. Airlift

Convair XC-99 takes off from Kelly AFB at San Antonio en route to Dover, Del., where it will start a record 300,000-lb. cargo airlift to Iceland. It is the largest task assigned to a single U. S. aircraft. The giant Air Force transport is expected to move the entire 150 tons of cargo in five roundtrips, each scheduled at 34 hr. KC-99 will refuel at Goose Bay during the Dover-Keflavik airlift.

Avionic Industry's Job Outlined

U.S. Air Force's ever-increasing reliance on avionics equipment means that the electronics industry must increase production while maintaining essential quality standards, Lt. Gen. Clarence S. Irvine, USAF Deputy Chief of Staff for Materiel, has made clear.

In accepting greater responsibility, Gen. Irvine re-emphasized before a Radio-Electronics-Television Manufacturers Assn. meeting in Chicago that USAF does not intend to let prime contractors, usually airframe makers, branch out into avionic fields if it can be avoided.

Pointing out that today's interceptors carry more than 2,400 lb. of avionics equipment, compared with 1,500 lb. ten years ago, Gen. Irvine said electronics complexity is one of the important reasons why USAF had to turn to the weapon system concept for procurement.

Introduction of the associate contractor, he said, was a step taken to make sure that USAF capitalizes on the abilities of the most proficient segments of industry. The associate contractor, given performance specifications by the prime contractor, is free to establish his own detailed design of the item.

The materiel officer, formerly a special deputy commander of the Air Materiel Command at Dayton, also made these points in reply to avionics industry critics:

• **The prime contractor** is responsible for overall design and development of the weapon system, but the associate contractor shares this job for his component. It is not USAF's intent to "encourage or condone industries to take over the development and production of parts or subsystems from the established industries which normally provide such equipment."

• **To control these procedures,** USAF determines which items are to be made by the associate contractor, insists on a substantial spread of subcontracting, permits deviations only with written approval and requires that prime contractors implement their own programs.

• **USAF will not** provide facilities except as a last resort and will finance them only when it is convinced there is no other qualified source of supply in existence.

• **Broad industrial base** and geographic dispersion of sources must be maintained.

• **Greater standardization** is a constant goal but not when enforcement will in any way limit capability of the weapon.

Cambridge Center Gets New Home

Air Force Cambridge Research Center, home of Project Lincoln and other scientific projects in operations, electronics and geophysics, is moving its headquarters and most of its personnel to new quarters at Laurence G. Hanscom Field, Bedford, Mass.

Offices of the 6520th Support Wing (Test) will move with the center and become 6520th Air Base Group, under the command of Col. Shepler W. Fitz-Gerald, Jr.

The major portion of the building program at the field is expected to be completed next year.

Warning System Costs

Details of USAF's plans for Fiscal 1956 Aircraft Control and Warning System construction are military secrets. Price for next year, however, is not classified.

The figure, for work in the United States and abroad: $211 million.

Some 80% of the program is for expansion of the electronic communication and control system, essential link between the warning net and the weapon systems.

Also on the schedule are facilities at existing permanent and mobile radar sites and construction of 74 new "gap-filler" sites.

Work will be continued on the DEW line across North America and at other overseas sites, including Alaska and Canada.

Armstrong Whitworth Opens New Tunnel

A Mach 3 wind tunnel for studies of thermal effects on highspeed aircraft and missiles has been opened by Sir W. G. Armstrong Whitworth Aircraft Ltd. at its Whitley guided missile plant.

Working range of the new tunnel is from Mach 0.3 to 3.0. Nozzle blocks are used to vary the Mach number; their size was determined by standardizing a test model for supersonic Mach numbers.

Automatic data recording and computing equipment has been developed and installed in the tunnel test house.

This is the first supersonic tunnel for AWA, and it will supplement an older intermittent transonic tunnel. The new unit was developed with company funds.

CAB Stands Pat in Pacific Case

The Civil Aeronautics Board has rejected requests of Pan American World Airways, Transocean Air Lines, and Trans World Airlines for reconsideration of the Board's decision in the trans-Pacific certificate renewal case (AW Feb. 14, p. 12).

Reconsideration petitions of the three carriers were refused by virtue of a Board stalemate. The vote was 2 to 2 on the motions and they failed for want of a majority. CAB Chairman Ross Rizley did not participate because he did not take part in the original decision. Vice Chairman Joseph Adams and Member Josh Lee upheld their previous positions supporting the applications of Taloa and TWA and would have granted the petitions. Members Gurney and Denny voted for denial.

Transocean's claim that the Board committed a prejudicial error in the first case was acknowledged by both Gurney and Denny.

The original decision denied Transocean's application on the grounds that it "already possesses authority as an irregular carrier to conduct the selfsame services." The authority of an irregular carrier does not extend to international service sought by Transocean. They said, however, "This does not in our judgment justify a change in the present decision." Adams disagreed. He said, "The error . . . should have been called to the President's attention since he may have relied upon that error in denying Transocean's application."

The two voting Republican members also turned down TWA's petition. Gurney and Denny said that "while the matters presented by TWA strengthen its position they are not sufficient to override the other considerations that dictate denial of its application." TWA particularly made a point of its subsidy-free operation and the subsidy situation in both the Atlantic and Pacific which has materially improved.

Direct service between the West Coast and Europe has been proposed by Trans World Airlines, subject to Civil Aeronautics Board approval.

TWA wants Los Angeles, San Francisco, Oakland, Portland and Seattle as co-terminals on TWA international routes. If the application is granted, TWA would be permitted to use the shortest, most direct course from any of the five Pacific Coast cities to London and Paris.

TWA officials pointed out that they might fly the "polar route," but want to be free to choose the most advantageous route with the new Lockheed Super G Constellations. The U. S. flag carrier now operates one-plane international service from Chicago and Detroit as well as New York, Philadelphia and Boston which is supplemented by domestic intercontinental service.

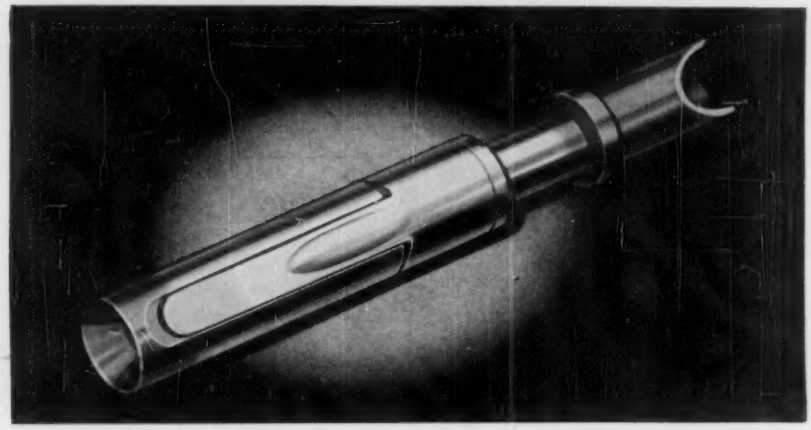
UAL Favors Jets

United Air Lines probably will order long range jet transports in its next large purchase of new aircraft. UAL will ask for delivery in 1959 or 1960.

"Our first preference for earliest delivery would be the turboprop for short-haul operations, to be followed by delivery of jet aircraft for longer-haul operation," said United President W. A. Patterson last week.

"However, our engineers are not yet satisfied that there is a proven engine for the turboprop, whereas we have in this country today the greatest jet engine in the world in the (Pratt & Whitney) J57. . . . Under these circumstances, the jet may come first. . . .

"It is difficult to evaluate the Lockheed Electra (AW June 13, p. 12) without detailed specification, which they advise us will not be completed for several months."



"CLIP-TYPE" closed entry socket contact now standard in

BENDIX-SCINFLEX ELECTRICAL CONNECTORS

Cannot be overstressed—eliminates intermittent circuit problems resulting from socket contact malfunction.

The heart of any electrical connector is the socket contact. This is why the Bendix-Scinflex* socket contacts have always been machined from bar stock. Stampings, with their required thin sections, can be easily overstressed.

Even with the machined sockets, industry has been plagued with overstressed spring leaves due principally to the misuse of test probes and lax tolerances on pin contacts. Bendix engineers have now provided the only socket contact on the market today which completely eliminates all these problems.

The "Clip-Type" socket will not accept any oversize probe or pin, nor can one be forced into it. Also, no amount of wrenching or twisting of an acceptable pin or probe can possibly distort the spring clip. This new socket is now standard in all Scinflex connectors including those using solderless, high-temperature and thermocouple contacts.

Our sales department will be glad to furnish complete information on request.

*TRADE-MARK

SCINTILLA DIVISION of Bendix AVIATION CORPORATION
SIDNEY, NEW YORK

Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

FACTORY BRANCH OFFICES: 117 E. Providencia Ave., Burbank, Calif. • Stephenson Bldg., 6560 Cass Ave., Detroit 2, Michigan • 512 West Ave., Jenkintown, Pa. • Brouwer Bldg., 176 W. Wisconsin Avenue, Milwaukee, Wisconsin • 8401 Cedar Springs Rd., Dallas 19, Texas • American Bldg., 4 S. Main Street, Dayton 2, Ohio • 1701 "K" Street, N. W., Washington 6, D. C. • Boeing Field, Seattle 8, Washington.

"How much will my heat exchanger weigh?"

The question was asked us by an engineer in a power plant pre-design group by phone. "Ball-park" figures would have satisfied his requirement at this stage of the planning of a new aircraft engine. With the performance requirement figures which he furnished us over the phone UAP engineers made their computations based on the Hi-D core configuration's ability to dissipate heat and we called him back one hour later with a positive 2 pound figure as opposed to his hoped for 5 pounds.

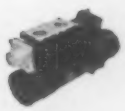
WE HAD THE ANSWER IN ONE HOUR

2 POUNDS!

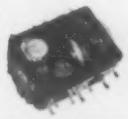
This is the kind of service which we like to give to the engineers in the aircraft industry UAP's 26 years experience in furnishing high precision components enables us to frequently furnish fast, accurate information to design groups far in advance of the actual need for the components. Let us quote weight and displacement figures in the pre-design planning of your developments.

CALL
- Dayton: Michigan 3841
- New York: Murryhill 7-1283
- Los Angeles: Stanley 7-7423
- Montreal: Elwood 4131

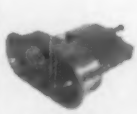
UAP — UNITED AIRCRAFT PRODUCTS, INC.



Heat Exchangers



Diverter Segregator Valves



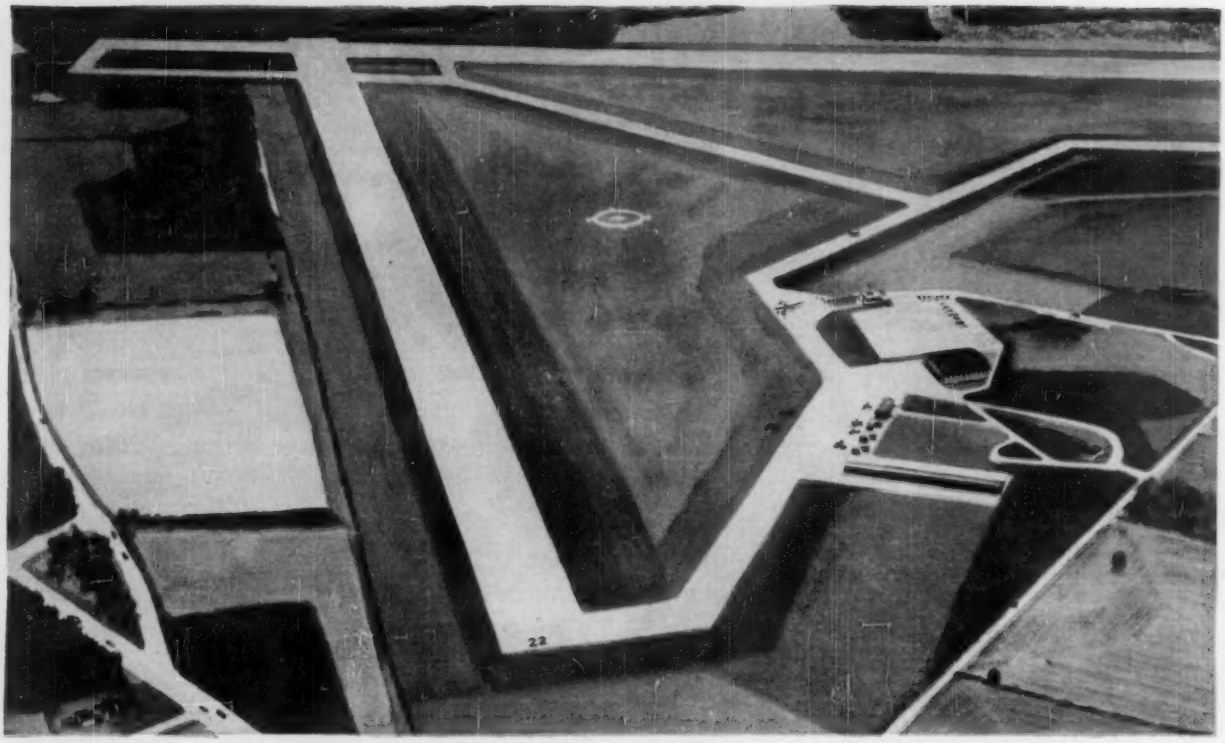
Cold Weather System Hoppers

Oil Tanks

Fuel Control Valves

UNITED AIRCRAFT PRODUCTS, INC.

1116 BOLANDER AVENUE, DAYTON, OHIO



"EXECUTIVE STOP" *for Washington D.C.*

Easton Municipal Airport Offers Complete Facilities for the Executive Aircraft Operator Who Travels to Washington, D. C.

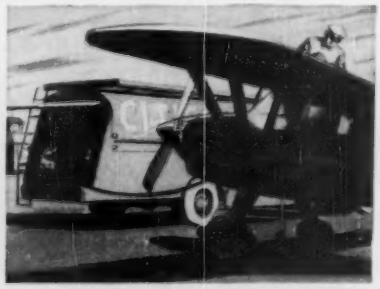
STOP AT THE EASTON MUNICIPAL AIRPORT IN MARYLAND

. . . Put down on either one of the two 4000 ft. paved runways. Receive complete Cities Service Aircraft Servicing . . . the finest in the world. Enjoy a leisurely ride into Easton in comfortable Cities Service station wagons. Spend a restful and enjoyable evening in the Tidewater Inn, Easton's ultra-modern, one hundred and twenty-room hotel. Arise refreshed the next morning and make your twenty-minute hop into Washington.

Easton's 500-acre Municipal Airport is the perfect answer for the busy flying executive who does business in Washington, D. C. Why not stop over next time you're near by?

Easton—A Regular Stop for Allegheny Airlines. Direct Service to New York and Washington.

Private Plane Operators—Busy flying executives find Easton the perfect stopover when en route to Washington, D. C.



Most Complete Servicing Facilities—Major aircraft and engine maintenance by Universal Aviation Services, Incorporated. Stonnel & Holladay, Aero Commander Distributors.

CITIES SERVICE

AVIATION PRODUCTS

New York • Chicago • In the South: Arkansas Fuel Oil Corp.

New Military Aircraft Order Lag Continues

New orders for aircraft and related procurement continued to lag through April, and Air Force and Navy had an unobligated balance of $8 billion on hand May 1—just two months before the close of Fiscal 1955.

Of the total unobligated fund USAF had $5.7 billion and Navy $2.4 billion.

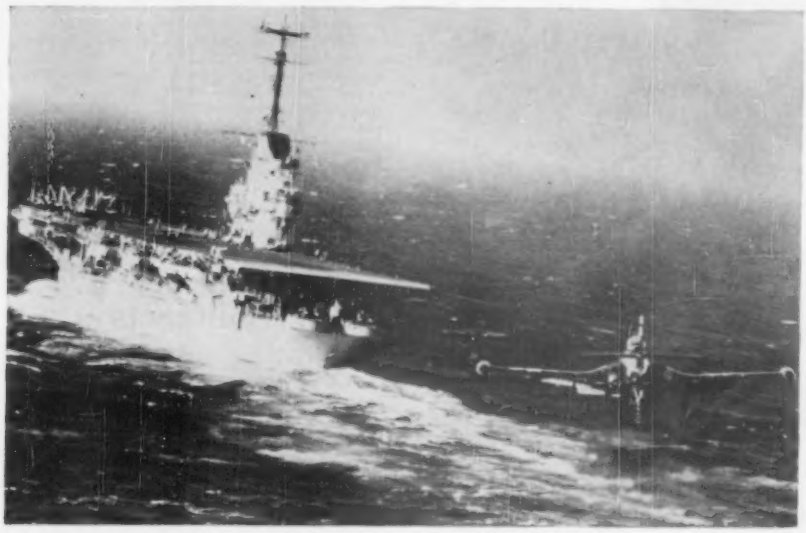
Navy had net obligations of only $79 million during April; USAF's net total was only $218 million.

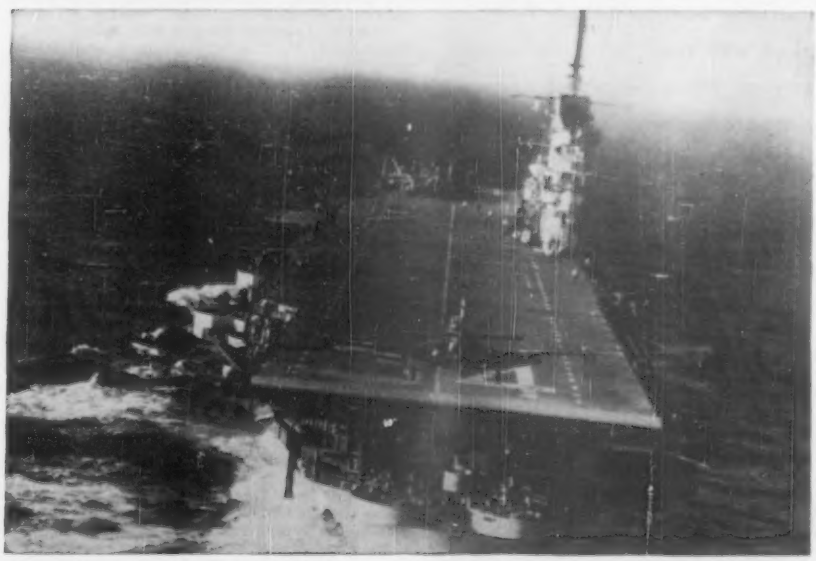
House Appropriations Committee a few weeks ago reduced by $150 million USAF's Fiscal 1956 funds for aircraft and related procurement because the carryover of Fiscal 1955 funds would be greater than anticipated. The committee said the carryover would be $2.9 billion. But the outlook is that it will be even larger than this.

To reduce its May 1 unobligated balance of $5.7 billion to $2.9 billion by July 1, the Air Force would have to obligate $1.4 billion monthly during May and June. USAF's average monthly obligation for the first 10 months of the year was $380 million. Navy's obligations for the first 10 months of Fiscal 1955 totaled $728 million, an average $72.8 million monthly.

The unexpended balance for aircraft and related procurement on May 1 was $19.8 billion. This was divided: USAF, $13 billion; Navy $6.8 billion.

Banshee Landing Seen From a Banshee . .





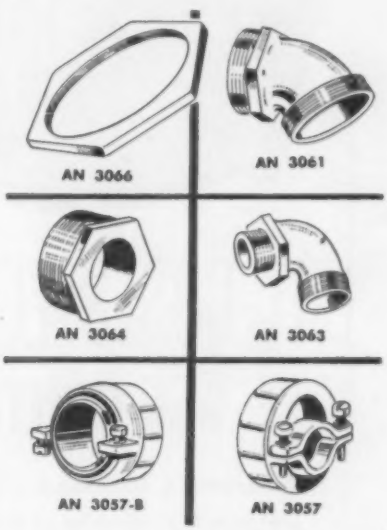
These photos of a McDonnell Banshee coming in for a landing on the USS Oriskany at about 110 knots were taken from an F2H-2P photo Banshee somewhere off the coast of California. The photo ship has a K-48 forward-firing aerial mapping and recon camera in its nose.

STANDARD PARTS AND EQUIPMENT CORP.

Your Fast, Dependable

SOURCE OF SUPPLY ON CONNECTORS AND ADAPTERS

We manufacture these connectors and adapters in a complete range of sizes.



The connectors and adapters pictured above are manufactured in our factory to rigid government specifications. Immediately available for fast delivery to fill your orders of any size.

Now—be sure you order from Standard Parts, where excellent facilities and experienced representatives are ready to handle your connector problems. For prices and delivery information, call, wire or write to the address below.

Write on your company letterhead for catalog listing the thousands of AN parts in stock.

STANDARD PARTS AND EQUIPMENT CORP.

Telephone Fannin 4458 • TWX FT 8010
P. O. Box 4506 • Fort Worth, Texas
OFFICES
105 E. 64th Place • Inglewood, Calif.
3916 East 13th • Wichita, Kansas

IT COSTS LESS TO FLY

WITH CONTINENTAL POWER

Continental's continuing interest in its product, after the sale, makes a big reduction in the cost of plane ownership and use. Continental aircraft engines are not only built to absorb their full share of punishment, but backed with the kind of service that keeps them running year after year. When major overhaul time rolls round, the owner can replace his engine with a factory-remanufactured power plant—back to zero hours, and with factory new engine guarantee—at very low fixed cost and with virtually no dead time. Continental's Factory Remanufacturing Plan is one more in a long list of reasons underlying pilot preference for planes with Continental power.

• • •

PARTNERS IN MAKING PRIVATE FLYING
THE SAFEST MEANS OF TRAVEL

1905 GOLDEN ANNIVERSARY 1955

Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN

Navy Contracts

Contracts recently announced by the Navy's Aviation Supply Office, 700 Robbins Ave., Philadelphia 11, are:

North American Aviation, Inc., Columbus Div., 4300 E. Fifth Ave., Columbus 16, Ohio, maintenance parts for AJ aircraft, $235,419.

Daystrom Instrument Div., Daystrom, Inc., Archibald, Pa., indicators, $57,660.

AiResearch Mfg. Co., 9851-9951 Sepulveda Blvd., Los Angeles 45, maintenance parts, $34,484.

American Pad and Textile Co., South Washington St., Greenfield, Ohio, preservers, $270,627.

Bell Aircraft Corp., P.O. Box 482, Fort Worth 1, maintenance parts used for HTL aircraft, $38,020.

General Textile Mills, Inc., 450 Seventh Ave., New York 1, helmets, 3,400 ea., $83,028.

Marine Compass Co., Mattakeesett St., Pembroke, Mass., compass, 10,100 ea., $30,300.

Meckum Engineering, Inc., Dayton Road, Ottawa, Ill., mast, 5 ea., $66,417.

Mine Safety Appliance Co., 201 N. Braddock Ave., Pittsburgh 8, mask assys., 1,400 ea., $41,186.

North American Aviation, Inc., Columbus Div., 4300 E. Fifth Ave., Columbus 16, Ohio, maintenance parts, $98,558.

Regent Jack Mfg., 11905 Regentview Ave., Downey, Calif., jacks, $111,110.

Robinson Aviation, Inc., Teterboro Air Terminal, Teterboro, N. J., kits, mounting, $27,048.

Turco Products, Inc., 95 Fairmount Ave., Philadelphia 23, compound, 24,000 gal., $32,640.

Weston Electric Instrument Corp., c/o Joralemon Craig and Co., 101 North 33rd St., Philadelphia 4, indicators, 1,089 ea., $35,011.

BuAer Contracts

The following contract awards of $25,000 and more have been announced recently by the Bureau of Aeronautics, Department of the Navy, Washington 25, D. C.:

Bendix Aviation Corp., Eclipse-Pioneer Div., Teterboro, N. J., transmitters, fuel flowmeter and spare parts, 176 ea., $47,880; air turbine starters, special tools and ground handling equipment, 237 ea., $352,462.

Bendix Aviation Corp., Red Bank Div., Eatontown, N. J., a.c. generators, high temperature, 30-kva. three-phase, 8,000 rpm., and static regulators, 3 ea., $36,788.

Caravel Films, Inc., 730 Fifth Ave., New York, N. Y., preparation of master shooting scripts with complete storyboards for three 20-minute motion picture training films, $34,788.

I. W. Foster Sportswear Co., Inc., Hancock & Westmoreland St., Philadelphia, develop, design and manufacture prototypes of proposed designs of a personal body armor ensemble for flight personnel, $25,000.

Land-Air Inc., 201 North Wells St., Chicago 6, prototype the following aircraft with individual instrument red lighting shields, models R5D-4R, R5D-Z, TBM-3S2, PBM-5S2, 1 ea., $30,948.

Letourneau-Westinghouse Co., 2301 N. Adams St., Peoria 2, Ill., cranes, salvage, crash, aircraft, 40,000 lb. capacity, type MB-2, 2 ea., $47,282.

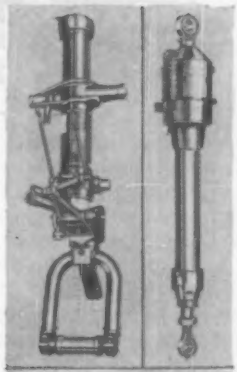
Northwestern University Aerial Measurements Laboratory, 2422 Oakton St., Evanston, Ill., furnish engineering services for operating the computer facilities and airborne assessment facilities, $49,768.

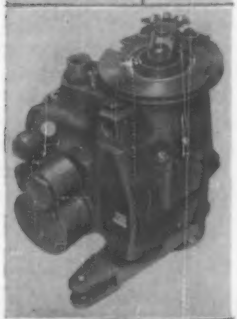
Reid H. Ray Film Ind., 2269 Ford Parkway, Saint Paul 1, Minn., preparation of the master shooting scripts w/partial storyboards for 21 motion picture films, $53,738.

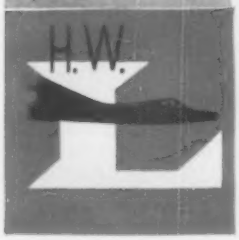
Soundrive Eng. Co., 3300 Cahuenga Blvd., Los Angeles 28, conduct noise field measurements on a full-scale turbojet with afterburner, $96,156.

Complete landing gear package by

LOUD







"Producing Today . . .
Tomorrow's Aircraft Requirements"

Loud is a new source for landing gear and components on the West Coast. Versatile equipment and facilities have enabled Loud to produce shock struts, shimmy dampers, steering units, drag brace assemblies, down locks, landing gear trunnions and actuating cylinders . . . a complete package for the aircraft industry.

Loud has experience in newer designs employing high heat treats of 260-280,000 psi and new materials such as Hy-Tuf and Titanium, which are now required in producing modern landing gear and components.

H. W. LOUD MACHINE WORKS, INC.

969 EAST SECOND STREET, DEPT. 10 • POMONA, CALIFORNIA

Engineering and design development by
Haskel Engineering Associates
Glendale, California

•

National Sales and Service by
Haskel-Loud Aircraft Service Corp.
Glendale, California

•

Resident Sales Engineers located in
Seattle, Wash.
Kansas City (Independence), Mo.
Baltimore, Md.

Gas Turbine Improves Performance

By L. J. Nuttall

The introduction of the helicopter, noted for its low-speed flight characteristics, appears to be an incongruous note in the transport race.

A second glance reveals that the helicopter, like the jet transport, is being introduced to keep up with civilization's rapidly increasing living pace. The ability of the helicopter to operate into downtown metropolitan areas eliminates the most time-consuming part of an airline trip of less than 200 or 300 mi.; the bus ride to and from the airport. Using the copter results in a significant decrease in total time.

The helicopter will bring the speed and convenience of air transportation to a great many smaller cities that have not been able economically to justify an airport but could maintain heliport facilities. This means a considerable increase in speed over the ground transportation now servicing these areas.

Speed itself is not a completely saleable commodity. The success of the helicopter as a commercial transport vehicle will depend on how well it can measure up to competing forms of transportation in matters of safety, comfort, convenience and economy as well as how much it can decrease travel time. Helicopters in commercial passenger service today are proving that there is a definite need for the type of service they can provide, even though they leave something to be desired in respect to some of these other factors. But, before the helicopter can hope to achieve widespread acceptance for commercial transport use, significant improvements will have to be made. One such improvement could be the geared gas turbine engine.

It wasn't until the Korean conflict had proven the utility and value of the helicopter that the government agreed to divert a part of the gas turbine industry's activities to build smaller size, shaft-power engines in order to adapt this powerplant to helicopters. Just as the jet engine has revolutionized combat aircraft, the geared gas turbine engine could overcome many of the shortcomings of reciprocating-engine-powered helicopters.

Copter Comparison

By taking advantage of the experience of large jet engine developments, it is now possible to design and build geared gas turbine engines with specific fuel consumptions comparable to reciprocating engines at the higher powers required for helicopter operation, and with specific weights less than one-third of that of reciprocating engines. This efficiency and light weight, combined with the simplicity, reliability, and flexible speed-power relationship of the gas turbine engine can make significant improvements in all four of the factors on which the success or failure of the commercial transport hinges: Speed, safety, comfort, and economy.

In order to find out just how significant these improvements can be, let's consider two hypothetical transport helicopters, each with a gross weight of 17,000 lb. One of these can be powered by two 1,250 hp. gas turbine engines (also hypothetical) which will provide sufficient power to maintain flight with one engine out, even on a hot day at altitude with full gross weight. Since the power of the reciprocating engine doesn't fall off as much on a hot day as does the power of the gas turbine, the other helicopter can be powered with two 1,000 hp. reciprocating engines to meet the same critical performance conditions. Hypothetical compound engines will be used for this latter helicopter, representing the latest known state-of-the-art for reciprocating powerplants. The two helicopters otherwise will be essentially the same.

The maximum flight speed for a helicopter is generally limited by retreating blade stall which is a function of rotor tip speed. The higher the tip speed, the faster the helicopter can fly before encountering blade stall. In contrast, it is desirable to operate at a relatively low rotor speed in order to obtain maximum takeoff and hovering performance.

With a reciprocating engine, horsepower output is directly related to the speed, with the high power needed for takeoff obtainable only at a high engine speed. At the lower cruise power setting, the engine should operate at a lower speed to obtain highest efficiency and longest life. The result is that the helicopter rotor is usually operated at nearly a constant speed as a compromise between the high engine speed and low rotor speed desired for takeoff and the low engine speed and high rotor speed desired for cruising.

Speed Increased

In the free-turbine engine, the turbine that produces the output shaft power is not mechanically connected to the compressor and compressor-drive turbine. Its output power is nearly independent of output speed over a fairly wide range (Fig. 1) so that full advantage can be taken of the rotor characteristics. Fig. 2 shows the rotor power required vs. flight speed for the two helicopters: The rotor of the turbine-powered helicopter can operate with a top speed of 540 fps. for takeoff and hovering and at 660 fps. for cruising as compared with a constant rotor speed of 600 fps. with the reciprocating engines. With the 10% increase in rotor speed, the maximum flight speed can be increased from 140 mph. to around 170 mph.

Increasing power is required with higher flight speeds. For the reciprocating engine, higher powers mean higher specific fuel consumption. As a result,

The author is a member of the Small Aircraft Engine Dept., General Electric Co., Lynn, Mass.

FIG. 1

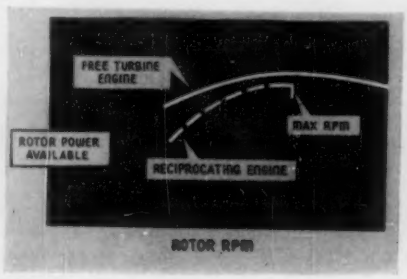


FIG. 2

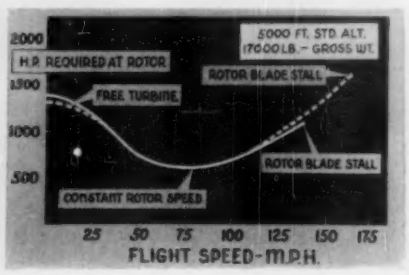


FIG. 3

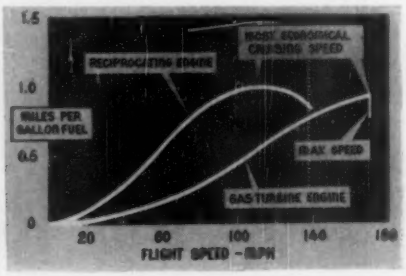


FIG. 4

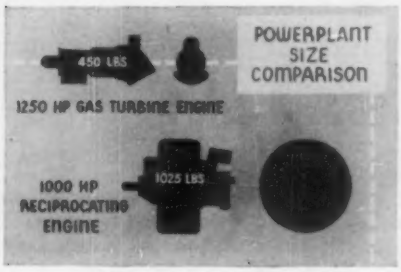


FIG. 5

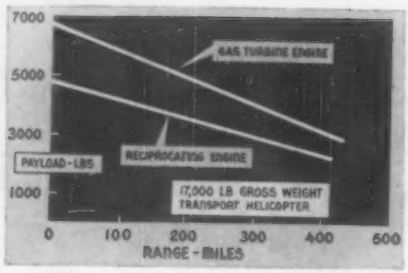
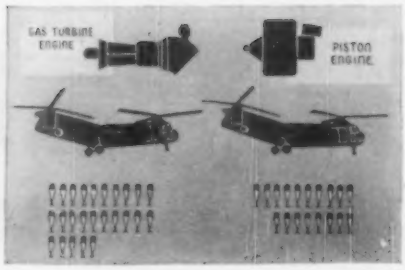


FIG. 6



the most economical cruising speed occurs at about 110 mph. (Fig. 3), which is well below the maximum speed. For the turbine engine, specific fuel consumption decreases with the higher powers and hence the most economical cruise occurs at top speed.

Safety Contributions

In addition, the turbine engine is designed to operate continuously at its normal power rating without detrimental effects to its operating life. Experience has shown that operation of reciprocating engines for extended periods of time at or near normal rated power results in decreased service life. Thus, in commercial transport operation, the helicopter powered with the reciprocating engines probably would not be operated much over 115 mph. while its turbine powered counterpart can be operated at more than 150 mph.

This means a possible reduction of en route time of more than 30%, significant for a vehicle whose existence can only be justified by its ability to save time.

Speed is only important as long as it can be achieved safely.

The helicopters in commercial service today have achieved an outstanding record of safety. Still, as operation progresses into more congested metropolitan areas, the turbine engine can make some definite contributions to safety.

The small size and high power-to-weight ratio of the gas turbine engine make it possible to install sufficient power to provide for any anticipated emergency.

There is 2,500 hp. installed in one copter powered by gas turbine engines for less than half the weight and volume required to install 2,000 hp. in the other with reciprocating engines (Fig. 4). This gives the pilot an extra 500 hp., on normal days.

Both of these helicopters are capable of maintaining level flight on one engine in the event of a failure of the other engine. But what would happen in the event of an engine failure on a hot day during takeoff from a very congested area where the pilot had not gained sufficient altitude or forward speed to permit him to fly out on one engine? It then becomes necessary to be able to hover with one engine out long enough to land.

With reciprocating-engine power, it would either require the installation of a third engine or installing two larger engines to prepare for such an eventuality should it prove necessary. This would be almost prohibitive from the performance standpoint.

A third gas turbine engine could be added to the other helicopter and it would still have an empty weight advantage over the original two-engine reciprocating installation.

But the characteristics of the gas turbine make the third engine unnecessary. Where excess power is required for short periods of time, the turbine can be operated above normal temperatures for the few seconds required to land the helicopter. The engine would have to be pulled for inspection and possible overhaul after such an emergency, but there would be no lives lost and no damage to the helicopter.

Fatigue and Noise

Pilot fatigue is another important factor in aircraft safety. The helicopter is particularly bad in this respect because of the high degree of pilot concentration required to fly it.

Here the gas turbine engine can offer some improvement over the reciprocating type. The control of the gas turbine is completely automatic, and will provide correct power for all normal operating conditions, maintaining the rotor speed constant at a value preset by the pilot. It is unnecessary for the pilot to touch the engine control at any time during normal flight conditions; with reciprocating engines he must adjust the engine throttle to maintain desired rotor speed.

Pilot fatigue is also directly affected by cockpit vibration and noise level.

Nearly all adverse comments received by the pioneering transport helicopter organizations are concerned with comfort. The most recurring complaints stem from the excess noise and vibration in the passenger compartment. Both of these conditions can be improved by the gas turbine engine.

The reciprocating engine, which derives its power from intermittent firing of the cylinders, contributes to the objectionable vibration noticeable in the cockpit and passenger compartment. It has been necessary to include a flywheel in reciprocating-engine installations to partially smooth out these impulses, but weight is extremely critical and it would be impossible to install a flywheel large enough to completely damp them out.

The gas turbine engine derives its power from continuous burning of fuel in the combustion chamber and a continous flow of gas through the turbine wheel. There are no power pulsations. What little vibration is induced by the engine will be of low magnitude and high frequency, which is easily isolated.

The geared gas turbine differs from the turbojet in that an additional turbine wheel is introduced into the path of the exhaust gases to extract the energy from them in the form of shaft power. As a result this turbine wheel serves as an effective silencer. Tests run on two separate experimental gas turbine installations have indicated that the noise level is at least 10 decibels lower than with a reciprocating engine in the same machine. In addition, the noise from the gas turbine is of high frequency and can easily be eliminated from the cockpit and passenger compartment with lightweight soundproofing material.

Turbine Economy

The final decision as to whether or not the helicopter will succeed as a commercial transport lies in its economy. The gas turbine engine can make its most important contribution in increasing revenue and decreasing operating costs.

The low specific weight of the gas turbine engine is its most significant characteristic because every pound reduction in the empty weight of a transport helicopter means another pound of payload it can carry and hence, more revenue. Fig. 5 shows a comparison of the payload which the two 17,000 lb. helicopters can carry for various ranges.

For a range of 200 mi., the turbine powered helicopter could carry 25 passengers while the reciprocating engine powered helicopter could carry only 18 (Fig. 6). Thus, for the same trip, using the same size helicopter, the

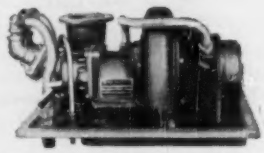
VICKERS "Instant Response"* HYDRAULIC MOTOR ... THE AIRCRAFT HANDY MAN

*Called "Instant Response" because it starts, stops or reverses almost instantaneously.

Vickers Constant Displacement Piston Type Hydraulic Motors are available in 24 sizes for 3000 psi.

Here Are a Few of the Jobs It Is Doing:

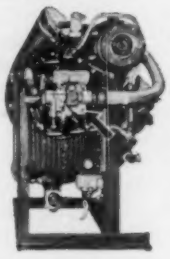
AERIAL REFUELING PUMP DRIVE



Fuel Transfer Pump built by Nash Engineering Co. for Boeing KC-97 Tanker. Powered by Vickers "Instant Response"* Hydraulic Motor.

CABIN SUPERCHARGING

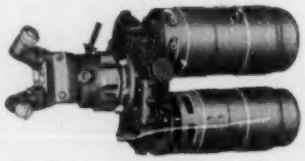
Douglas DC-7 Cabin Supercharger is driven by Vickers "Instant response"* Hydraulic Motor.



HORIZONTAL STABILIZER ACTUATOR

Built for Grumman F9F6 by Cleveland Pneumatic Tool Co. Powered by Vickers "Instant Response"* Hydraulic Motor.

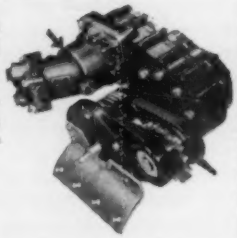
ALTERNATOR GENERATOR DRIVE



Alternator Generator Drive for Convair T-29 uses Vickers "Instant Response"* Hydraulic Motor.

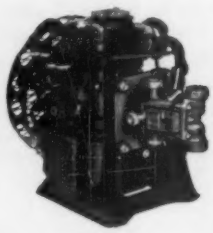
TELESCOPING BOOM ACTUATOR

Built by Jack & Heintz to extend and retract boom for in-flight refueling. Driven by a Vickers "Instant Response"* Hydraulic Motor.



AIR COMPRESSOR DRIVE

Built by Walter Kidde & Company, Inc. and driven by Vickers "Instant Response"* Hydraulic Motor.



What Can It Do for You?

These light-weight, compact, highly efficient hydraulic motors provide high power in a very small package. Their overall efficiency exceeds 92% . . . their volumetric efficiency exceeds 96%.

Operating characteristics are remarkable. These motors will stop from maximum speed in from .116 to .167 of a revolution . . . will accelerate from standstill to maximum speed in from .00019 to .0051 sec (depending on size). They can be stalled indefinitely without damage.

Vickers Hydraulic Motors have many uses on aircraft . . . just a few of them are shown above. Wherever you need high torque, high efficiency and high horsepower-weight ratio . . . or where instantaneous and positive control are required, these motors are your best choice. Write for Bulletin A-5205.

7044

VICKERS
Incorporated
DIVISION OF THE SPERRY CORPORATION
1462 OAKMAN BLVD. • DETROIT 32, MICHIGAN
Application Engineering and Service Offices:
El Segundo, California, 2160 E. Imperial Highway
Arlington, Texas, P.O. Box 213
Detroit 32, Michigan, 1400 Oakman Blvd.
Additional Service Facilities at:
Miami Springs, Florida, 641 De Soto Drive
TELEPHONE: TOwnsend 8-5100 • TELETYPE: "TWX" DE89
TELEGRAMS: Vickers WUX Detroit • CABLE: Videt Detroit

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

FIG. 7 (multiply seat-miles x 10)

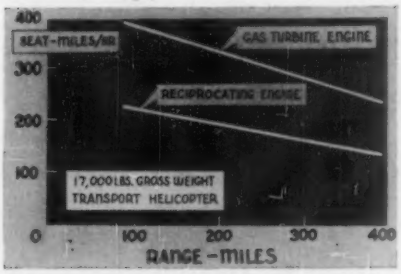


FIG. 8

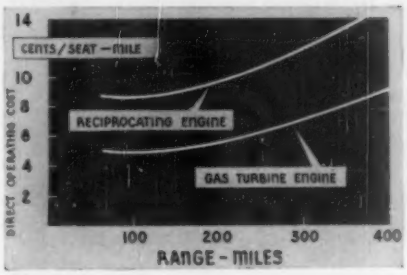
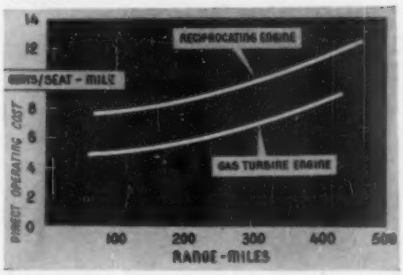


FIG. 9



gas turbine can increase the revenue by nearly 40%.

But that doesn't tell the complete story. While revenue is proportional to the number of ton-miles (or passenger-miles) of payload carried, operating costs are a function of the number of hours of utilization. A more realistic figure of merit to use for the comparison of the two helicopters would be the ratio of revenue to cost, or passenger-miles per hour.

The turbine-powered helicopter requires only 1.4 hours to complete the 200-mi. trip at 150 mph., while 1.8 hours are required by the reciprocating engine powered vehicle flying at 115 mph. The figure of merit for the former would be 3,530 seat-miles/hr. as compared with 1,990, which represents an increase of about 77% (Fig. 7).

Cost Comparisons

The direct operating costs, on a dollars per hour basis, will be slightly higher with gas turbine engines ($211/hr. vs. $193/hr.). But because of the higher figure of merit, direct operating cost in cents per seat-mile can be reduced by almost 40% with gas turbine engines (Fig. 8).

If a reciprocating engine powered helicopter were designed for the same capacity (25 passengers) as the 17,000 lb. turbine-powered helicopter, it would require a gross weight of about 22,000 lb. The direct operating costs for this helicopter would be around $236 per hour, which would result in the costs per seat-mile shown on Fig. 9. While these costs are a little lower than those of the 18-passenger helicopter, they are still almost 45% higher than those for the 25-passenger turbine powered helicopter.

Even though the gas turbine will consume more fuel than the reciprocating engine (243 gal. as compared with 218 gal. for a 200-mi. trip) the cost of JP-4 fuel for the turbine engine is about 18 cents per gallon while aviation gasoline costs about 26 cents per gallon. The total fuel cost for the 200-mi. trip, therefore, would be reduced from $56.70 down to $43.70 by using the turbine engine. This represents a reduction of about 23% in fuel costs for the 25-passenger helicopter.

Purchase and Maintenance

Initially, geared gas turbine engines may cost more than equivalent engines. This difference has been taken into account in the above operating cost comparisons. As time goes on the cost of the gas turbine should decrease, and eventually the cost in dollars per horse-

Cole Electric Co.

8439 STELLER DRIVE • CULVER CITY, CALIFORNIA • TEXAS 0-4701

Intervalometer
Rocket Firing
8 M.S. Interval
Hermetically Sealed

DESIGNING, ENGINEERING AND PRODUCTION FOR THE AIRCRAFT INDUSTRY

- Switches
- Heaters
- Intervalometers
- Frequency Relays
- Power Relays
- Transformers
- Rectifiers
- Rocket Releases
- Rocket Indicator Switches
- Bomb Racks
- Air Circuit Breakers
- Oil Circuit Breakers
- Switch Housings
- Throttle Switches
- Limit Switches
- Switchboards

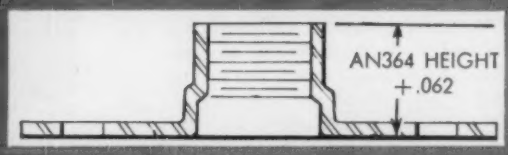
. . . and many other products. Specialists in hermetic sealing. Write us regarding your requirements.

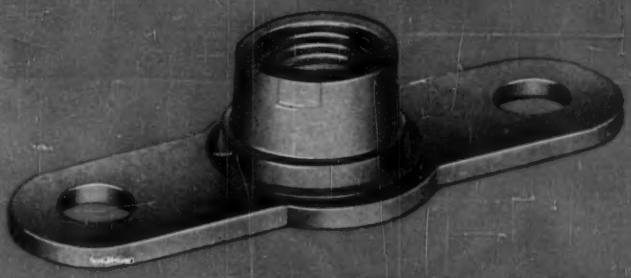
featherlight

HIGH STRENGTH
AIRCRAFT QUALITY STEEL
AN364 THREAD HEIGHT
.062 THREAD RELIEF

Series 12600 self locking, sheet metal nuts are designed as the *ultimate answer for light weight* AN362F-AN366F series anchor nuts.

The thread relief design eliminates the need for the first shim, thereby making the *lightest assembly* possible.





COMING SOON. Other styles and types in this basic design.

These high strength, low height anchor nuts are fabricated from A.I.S.I. 4130 aircraft quality steel. They exceed requirements of Spec. AN-N-5 and AN-N-10 and are designed to meet requirements of MIL-N-25027 (ASG).

Self locking, sheet metal nuts in Series 12600 withstand temperatures up to 550° F and employ the *triple lock* locking method.

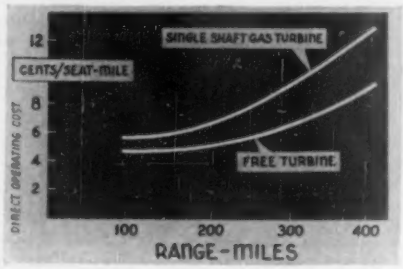
Nutt-Shel

811 Airway, Glendale 1, California. Telephones: CHapman 5-3693 and CItrus 4-4191

MANUFACTURERS OF SELF LOCKING NUTS AND BOLT & NUT RETAINERS.

power should approach that of reciprocating engines.

FIG. 10



The maintenance costs for the gas turbine were also estimated to be higher than for the reciprocating engine in the above comparison. As service experience is gained with this new type of powerplant, however, the simplicity of the engine and its ability to operate for extended periods of time at powers at or near normal rated power should result in overhaul periods more than double that of current reciprocating engines in helicopter service. The combination of this increased service life with the decreasing cost of replacement parts should bring the maintenance costs for the gas turbine well below those for the reciprocating engines.

Another factor not considered in the cost analysis is the possible decrease in airframe maintenance and depreciation caused by the absence of vibration. There is no way of estimating accurately what this effect might be; but airframe depreciation accounts for almost 30% of the total direct operating costs, and any decrease in this item could appreciably effect the total.

The cost figures shown for the gas turbine engines have been based on a free-turbine configuration as mentioned previously. A single-shaft gas turbine is similar to the reciprocating engine in its speed-power relationship; maximum power can only be achieved at maximum rpm., and highspeed operation at cruise powers results in decreased efficiencies. The effect of this inflexibility on the operating costs of the 17,000 lb. helicopter is shown on Fig. 10. While its light weight still gives it a decided advantage over the reciprocating engine, it cannot approach the operating economy possible with free-turbine engines. For this reason, just about every new gas turbine engine being developed for helicopter propulsion is of the free-turbine type.

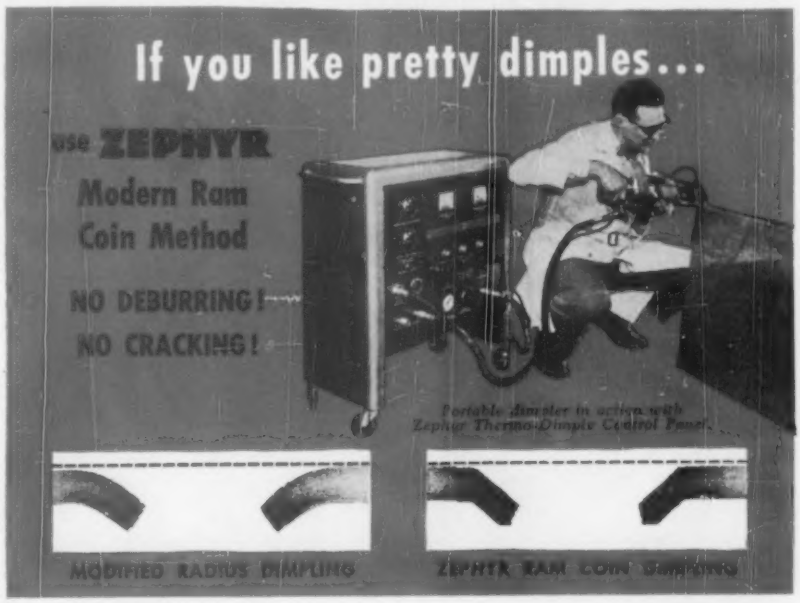
Several new gas turbine engines are now being developed specifically as helicopter powerplants, in addition to a few current gas turbine engines which have been adapted for helicopter use. The gas turbine and the helicopter industries, both matured since World War II, are teaming up to bring to the air-minded population a revolutionary new transportation medium. If the proposal to have new helicopters service-tested by commercial operators is adopted by the military, turbine-powered helicopters may be in commercial operation within a few years.

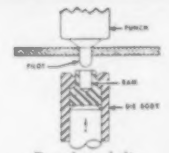
NACA Studies Air Dumping

It's just as important and difficult to return high-pressure air to the outside airstream as it is to take it on board the aircraft.

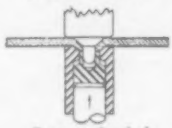
Designers of internal flow systems have been hampered by the lack of available data on discharging high-pressure jets into a transonic stream; outlet configurations have been empirically derived and were not necessarily best from drag or pressure considerations.

A series of tests have been made by NACA at Langley Laboratory to develop outlets to solve the problem of returning high-pressure air in an efficient manner. Data for discharge coefficients and pressure distributions near the outlets have been summarized in: **• A Preliminary Investigation of Aerodynamic Characteristics of Small Inclined Air Outlets at Transonic Mach Numbers** (TN 3442); by Paul E. Dewey, Langley Aeronautical Laboratory,





Punch and die assembly in normal open position. Note relation of ram face to die face.



Pressure loaded coining ram fully depressed; dimpling cycle completed.

CRACK FREE—100% safe dimples are assured with Zephyr's ram coin dimpling method.

IT WILL BE WELL WORTH WHILE to examine Zephyr's 40-page section of catalog No. 15. Here is conclusive evidence that Zephyr's method, in wide aeronautical use, will:

- Eliminate circumferential and radial cracks
- Easily control material distortion
- Provide perfect nesting
- Assure super flush rivets
- Eliminate all deburring
- Give precision dimple dimensions
- Assure higher shear value
- Assure aerodynamically true surfaces.

ZEPHYR

MANUFACTURING COMPANY, INC.
Sales Division
Inglewood, California

ZEPHYR MANUFACTURING COMPANY, INC.
Sales Division · Inglewood, California
PLEASE SEND ZEPHYR CATALOG NO. 15 ON RAM COIN DIMPLING

COMPANY

DIVISION OR DEPT. HEAD

ADDRESS

CITY ZONE STATE

Engineered for fool-proof maintenance . . . Edison's continuous cable fire detection system

Now a solid coaxial cable linked to a control assembly designed without electronic tubes or complex mechanisms assures maintenance-free service with least amount of personnel training. Low impedance operation eliminates possibility of false alarms due to moisture or capacitive effects in the new EDISON aircraft fire detection system.

Another important development from the world-famous EDISON Laboratory that increases the reliability of this system is its ability to signal fire even with a break in the sensing cable.

Check these other outstanding features, too:

- **direct operation** – from 28 volts d.c. without amplifiers of any kind.
- **rapid response** – signals "Fire Out" automatically; responds repeatedly to fire exposure.
- **extreme flexibility** – permits installation in irregular and inaccessible spaces.
- **maximum versatility** – a single detector circuit may have varying temperature alarm points.
- **simple to install, easy to maintain**–exclusive spring clamps reduce cable installation to seconds, and there are no brittle parts to fracture in the easily flexed cable.

Here is the finest fire detection system . . . especially designed for today's high-speed, high-performance aircraft. *Write today for complete details.*

Thomas A Edison

A GREAT NAME CONTINUES GREAT NEW ACHIEVEMENTS

Thomas A. Edison

INCORPORATED

INSTRUMENT DIVISION • 49 LAKESIDE AVENUE • WEST ORANGE, NEW JERSEY

THRUST & DRAG

From Dick Bean, a Lockheed drum-beater who has earlier commented on such diverse subjects as supersonic fish (Salmon) and Maching birds, comes this story of how some Super Connies were held on the ground by a bunch of threads.

The sound-proofing material was to blame; it didn't meet flame-proofing specifications and delayed final rollout of a batch of Super Constellations. Thus, threads tied them down.

* * *

Bell Telephone's little propaganda folder that comes with your phone bill each month is a fascinating journal, with local history, some material about Bell's contribution to industry or defense, and clever arguments for renting an extension phone.

One of the company's recent folders has a most intriguing thought about linking dial systems and Nikes.

"When an operator dials a number 3,000 miles away," the bulletin states at the bottom of a page about Nike, "she commands across the land a great variety of devices to go to work to track down that one telephone, out of many millions, and ring its bell within a few seconds' time."

Now let's paraphrase that one: "When the fire-control officer dials a number some miles away, he commands batteries of radar and Nikes to go to work to track down one enemy airplane, out of many attacking craft, and to blast it out of the sky within a few seconds' time."

You can get ideas from the darndest places.

* * *

There's a flap on in England right now about the lack of ejector seats in one contemporary plane used by both RAF and Royal Navy.

Reporting the story, the London News-Chronicle printed some notable quotations about the situation:

"When the aircraft was designed, no ejector seat was available that could be fitted into the cockpit layout."–Air Ministry and Admiralty.

"When the specification was laid down by the Service department, no ejector seats for the pilot and navigator were asked for."–Manufacturer of the aircraft.

"If ejector seats had been asked for, they could have been made."–Manufacturer of ejector seats.

"The first aircraft flew in 1949 and the two-seater version in 1951. . . . Surely something could have been done in all those years."–Pilot.

So there you are.

–DAA

ENJAY BUTYL outstanding for...

AUTOMOBILE
AXLE BUMPERS, TOPS,
WINDOW SEALS, HOSE

HIGH VOLTAGE
POWER CABLE
INSULATION

LONG-WEARING
AGE-RESISTANT
TRACTOR TIRES

THE PRODUCT
YOU
MANUFACTURE

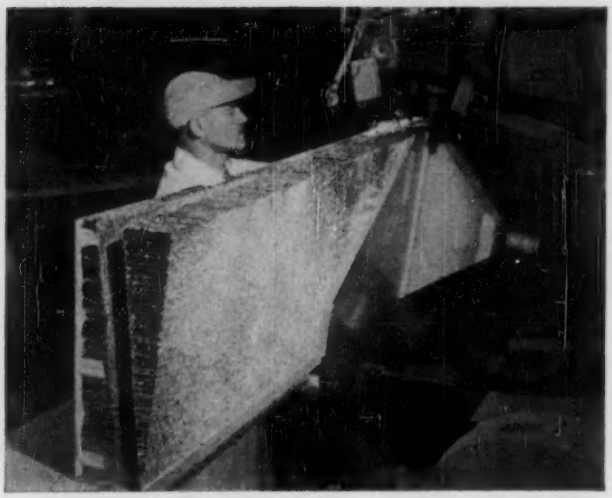
?

ENJAY BUTYL

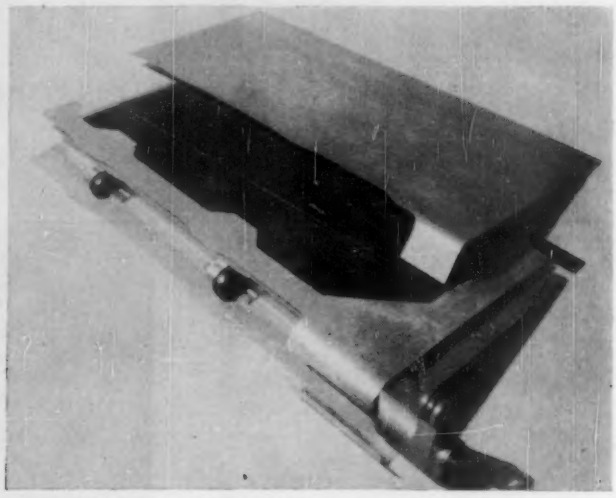
Enjay Butyl resists heat and cold . . . won't chip or crack . . . resists chemicals . . . retains flexibility and resilience . . . resists the aging effect of sunlight and ozone . . . is impermeable to air and other gases. Enjay Butyl is the only type of rubber, natural or synthetic, that offers this combination of advantages—and at low cost. That's why Enjay Butyl is being selected as the best rubber for more and more industrial products.

To find out how Enjay Butyl can improve your product, contact the Enjay Company. Our technical representatives and laboratories are at your service.

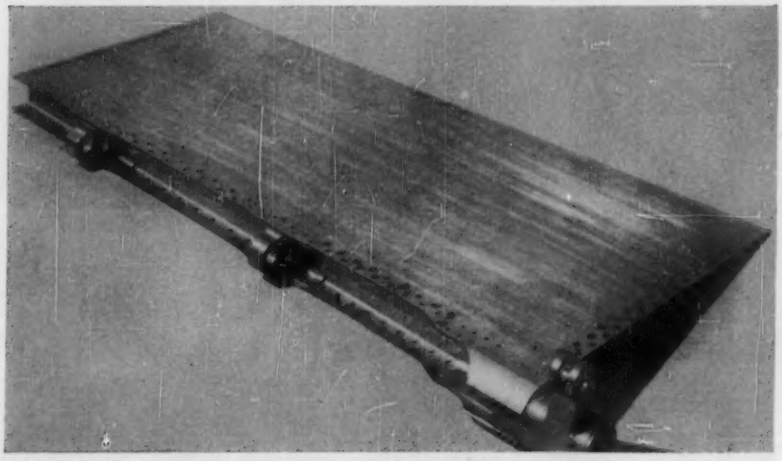
ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.
District Office: 11 South Portage Path, Akron 3, Ohio



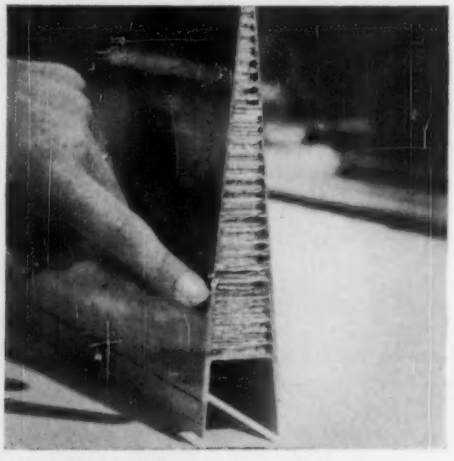
ALUMINUM HONEYCOMB is set up on bandsaw ready for cutting.



DISASSEMBLED F-102 RUDDER shows saw tapered aluminum core.



F-102 RUDDER with honeycomb proved 50% more rigid than conventional structure.



F-101 STABILATOR trailing edge has core.

New Fighters Use Resin-Bond Honeycomb

By Irving Stone

San Diego—Honeycomb structures developed for high-production applications are helping to accelerate the structural revolution in aircraft detail design.

All-metal honeycomb sandwiches—bonded by resistance welding or brazing—are still largely under development; resin-bonded sandwiches structures have been refined for production use.

Benefits of these structures include high strength-weight ratios, inherent rigidity and aerodynamic smoothness.

F-102 Applications

The important role resin-bonded metal honeycomb is playing in airframes and related components is highlighted by Narmco Mfg. Co.'s production of typical parts for today's fast aircraft:

• **Convair F-102 wing tip.** This unit for the supersonic interceptor measures approximately 4½ ft. long, 2½ ft. wide, with thickness tapering from 2½ in. to ½ in. The configuration has compound curvature incorporating washout. The part weighs about 18 lb. against a conventional makeup weight reported to be about twice as much. Constant specified operating temperature is 240F. For intermittent operation the part could go to 350-375F.

Hexcel Products core is ¼ in. (across flats) .002 aluminum. Skins are .040-in. 75ST Alclad. Spar is made from two 75ST extruded T-sections. Periphery is a series of magnesium castings. Closing end rib is 75ST formed sheet.

Imbedded in the structure is a navigation light with ½ in. aluminum conduit running through the center of the core.

In this and the other F-102 applications which follow, bonding of core to core sections and core to spars, closure ribs and fittings is done with Shell Epon 8 high-viscosity adhesive because of its void-filling characteristics. This bonding is done in an oven but not under pressure other than a fixture to keep the parts in relative position to each other.

Final bonding of skin to the subassembly of core, spar and periphery fittings is done with Narmco's 402 high-temperature tape in an autoclave at 350F for 2 hr. at a pressure of 65 psi. This pressure is used to insure even distribution of force to overcome effect of dimensional discrepancies.

• **F-102 rudder.** This unit is about 4½ ft. long, 2½ ft. wide, with thickness tapering from 3 in. to ¼ in.

Hex core is ⅛-in., .001-in. aluminum. It is tapered by bandsawing, and a slight compound curvature is obtained by hand-sanding.

Spar is a .040-in. aluminum channel. Trailing edge portion is a magnesium

casting. Hinge and control arm fittings are machined from aluminum alloy forgings. End closure ribs are sheet metal.

Skins are tapered 75ST. Under the skin, at the spar and lower closing rib, is a .040-in. scalloped doubler.

In strength comparison tests, a conventional rudder of rib-riveted sheet metal construction failed at 140% of ultimate design load. The aluminum honeycomb sandwich rudder of same weight failed at about 170% of ultimate design load, proved to be about 50% more rigid than the conventional structure.

• **F-102 elevon trailing edges.** These components vary in length from about 6 to 8 ft., are approximately 8 in. wide. Core is ⅛-in. hex, .001 aluminum honeycomb, with thickness tapering from about ¾ in. down to ⅛ in.

Spar is 75ST extrusion. Face skins are wrap-around .020-in. 24ST6. Fittings are machined aluminum alloy.

A thin metal doubler extends from the spar back over the honeycomb for about ¾ in.

• **F-102 wing fences.** These units vary from about 1½ to 7 ft. in length. Replacing solid fences of the same size, they save considerable weight.

Core is ⅛-in. hex, .001-in. aluminum honeycomb about .210 in. thick. Face skins are .016-in. 24ST3. Core is sealed with capstrip of .016-in. U-channel. Magnesium T-section extrusion attaches fence to wing.

• **F-102 nose wheel door.** Core for this part is about 2 in. thick, with a dished contour. Edge of the part is a drop-hammered S-section. Skins are 24ST.

Overall measurement of the door is about 4½ ft. by 2 ft.

The honeycomb makeup cuts weight and affords the rigidity necessary in this type of unit.

F-101 Applications

• **McDonnell F-101 stabilator trailing edge.** This movable stabilizer portion is approximately 8 ft. long, 1½ ft. wide, tapering to about 1 ft. in width at the outboard end. It is approximately 3 in. deep at widest section.

F-102 WING FENCES have core-skin sandwich attached to wings with T-extrusion.

Cross-section of the part, a long V-section, has the included angle changing about ½ deg. from inboard to outboard. This requires that the core (¼-in. hex, .002-in. foil aluminum) be cut to a varying angle throughout its entire length.

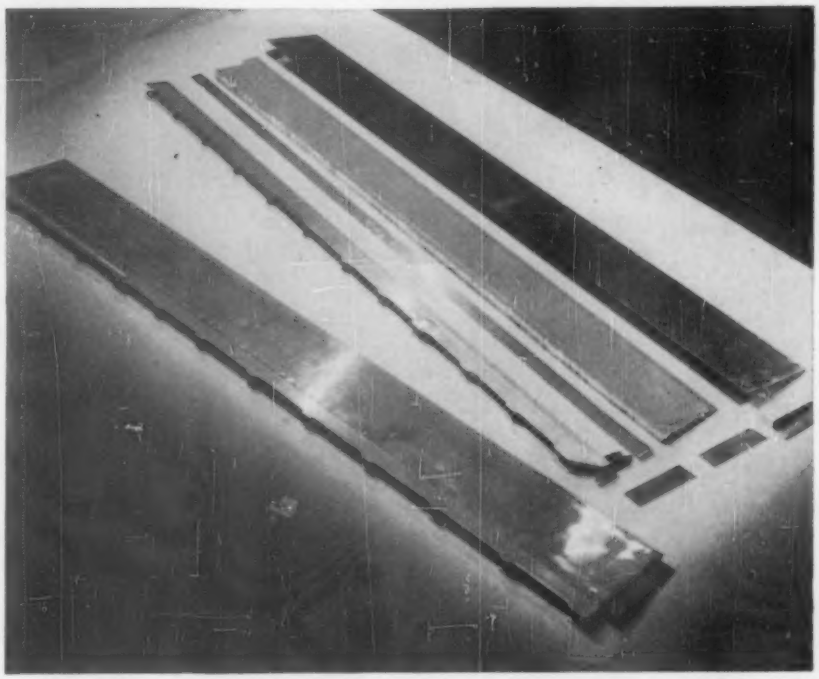
The 24ST .020 faces are bonded to the honeycomb with Narmco's 102 general-purpose adhesive system, instead of the company's 402 adhesive.

Spar and end closing ribs are formed of .032-in. 24ST sheet. A scalloped doubler bonded between face and core extends from the spar to the trailing edge. Core under the doubler is of a different density and has its ribbons running at 90 deg. to those in remainder of the part's core. These two cores, one Hexcel, and the other made by Flexo Mfg. Co., are edge-bonded to each other.

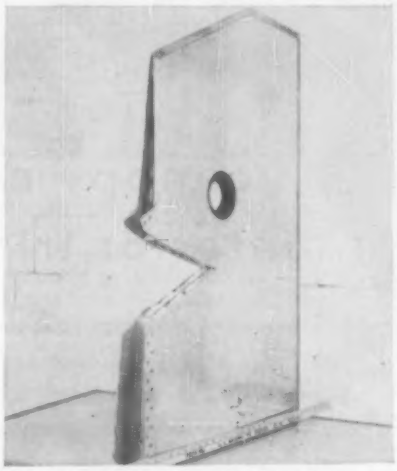
Core stops ¼ in. from the trailing edge and an epoxy putty is extruded into the opening to provide the part with a tough edge.

• **F-101 rudder trailing edge.** This unit has no twist, in effect is a simplified version of the stabilator.

The component is about 5½ ft. long, tapering from about 1½ ft. wide at lower end to about 1 ft. at upper end.



F-102 ELEVON trailing edge. Complete unit is in foreground, parts are behind it.



F-102 WINGTIP is sectioned to show core.

NARMCO makes 20-ft.-long sandwich part.

Metal-Glass Plastics Structures

Another huge honeycomb structure Narmco manufacturers for a Convair plane is about 20 ft. long, about 5 ft. in diameter at the widest point of its

the industry's choice for
better fabrication . . .
AVIATION FABRICS
to specification by

Sawyer

. . . for highest quality
canopy covers . . .
interior trim . . . insulation

Backed by more than 100 years of extensive laboratory facilities in the hands of expert research engineers — SAWYER'S Coated Aviation Fabrics set the standard for the highest quality product available to the aircraft industry — vinyl-coated cotton, nylon, glass cloth and other synthetics. Contact your nearest representative or write us for samples of our Specialty Aircraft interior and exterior coated fabrics as well as our upholstery fabrics for interior trim with our Aircraft Finish — manufactured in all types, colors, weights and widths to government and AAF specifications.

THE H. M. SAWYER & SON CO.
Coated Fabrics Division . . . Established 1840
WATERTOWN 72, MASS. WAtertown 4-0520

FROG BRAND ®

NEW YORK: Walter I. Schutt, 18 East 41st St., MUrray Hill 5-3611; William E. Mitchell, 15 West 26th St., MUrray Hill 6-8750
ATLANTA: Maurice E. Woods Co., 83 Cain St., N.E., CYpress 4218 **CHICAGO:** D. Russell & Co., 331 South Peoria St., TAylor 9-7471 **DALLAS:** W. L. Mellor Co., 1507 Dragon St., RAndolph 8479 **KANSAS CITY:** W. L. Mellor Co., 2603 Warwick, GRand 6850 **LOS ANGELES:** John Sweeten, 516 South St., Andrews Pl., DUnkirk 7-2587 **SEATTLE:** R. C. King, Inc., 117 Madison St., SEneca 1740

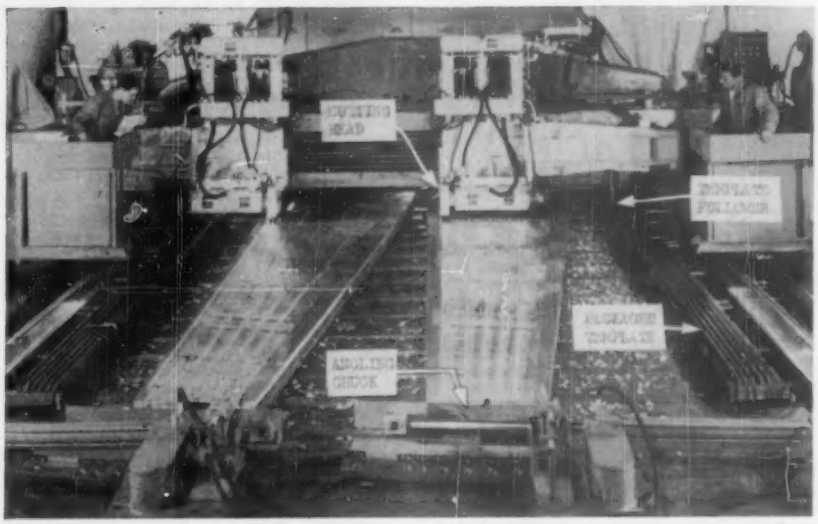
tapering shape. It is composed of eight main sections.

Only the core is metal. This is a ½-in., .002-in. aluminum foil Multiwave material manufactured by Narmco Resins & Coatings Co., and selected because of the extreme compound curvature of the sections. It is bonded to Narmco's phenolic-impregnated Fiberglas Conlon with the company's 102 adhesive.

These Conlon faces are .030 in. thick, except at periphery of the individual sections and at access doors, where the sandwich structure is replaced by ½-in. solid Conlon edging.

The major sections are bonded and riveted together.

Converted Millers Speed Output Of North American F-100 Wings



CONVERSION OF SKIN MILLER by Simmons saved NAA time and money compared with procurement of new tool. Machine will make integrally stiffened F-100 wing skins.

By Henry Lefer

Albany—Conversion of a 13-year-old, 300,000-lb. pit planer to a modern, highspeed skin miller for machining integrally stiffened aircraft wing sections has just been completed here by Simmons Machine Tool Corp. for North American Aviation, Inc.

The converted miller is pretty much a twin of one already in operation at NAA-Ingelwood. Both machines are unused Betts pit planers bought by North American from government surplus for modification. NAA engineers rebuilt the unit now in operation and contracted the other out to Simmons. The cost is perhaps one-half to one-third that of new machine to do a comparable job, according to Simmons. And because of the inherent rigidity in the heavy Betts planer, the conversion may prove superior to new machines of the same type, says Charles Morlath, of NAA's Industrial Engineering Dept., who is in charge of the conversion project.

The skin miller is set up for simultaneous cutting of integrally stiffened upper and lower skins for the F-100 Super Sabre. In acceptance tests Simmons ran for North American, right-hand upper and lower sections were cut separately in a little under 7 hours each. It produced simultaneously, the time per panel would be cut in half. Simmons' works manager, Pat Bruno, gives the machine's average longitudinal cutting speed as about 70 in./min. However, Morlath says that NAA will undoubtedly run the machine faster, giving a shorter production time, when it is fixed in its permanent foundation at Inglewood.

With other tooling, the machine can be adapted to other jobs. Using five vacuum chucks, it can produce five F-100 leading edge panels simultaneously. It will accept 1¾-in. 75ST aluminum plate 18 ft. wide by 25 ft. long, and can be adjusted to take thicker plate. The machine itself is 12 ft. high by 25 ft. wide by 30 ft. long.

Two 60-hp. milling heads take the place of the single-point tooling on the original Betts machine. The carbide-tipped cutters are 2 in. wide and 14 in. in diameter. Mounted on the spindle nose of the motors, they turn at 3,600 rpm. for a surface speed of about 13,000 fpm., removing material at a rate up to 250 cu. in./min.

Longitudinal cutting feeds vary from 20 to 150 in./min.; transverse feeds are

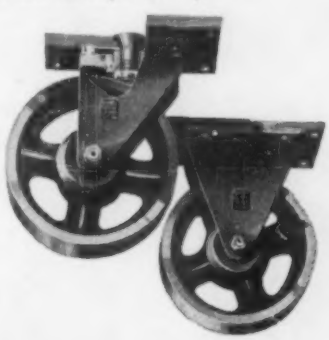
MORE SERVICE PER DOLLAR

DARNELL CASTERS & E-Z ROLL WHEELS

...OVER 4000 TYPES of CASTERS & WHEELS

All types of rubber treads - soft, medium and hard - for smooth operation on all kinds of floors. Featuring Neoprene rubber treads - resistant to steam, water, oxidation, oils and waxes and unaffected by most chemicals - expertly compounded to Darnell standards in our own rubber factory.

All Darnell Casters, whether steel or rubber tread, are available with various top plates, stems and fittings for any type of application. Or, Darnell engineers will gladly design a special type caster for your own individual equipment. Demand Darnell for Dependability.

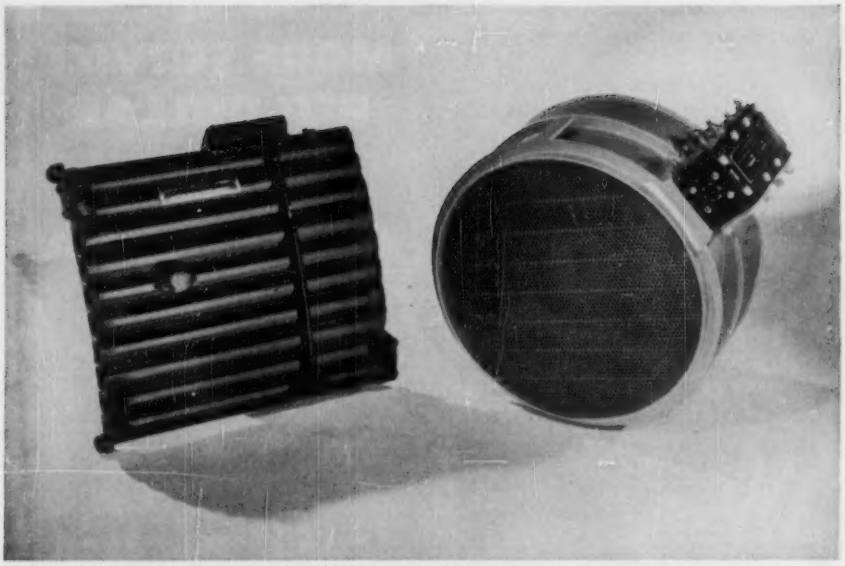


DARNELL CASTERS & WHEELS

Always SWIVEL and ROLL

Free Manual

DARNELL CORPORATION, LTD.
DOWNEY (LOS ANGELES COUNTY) CALIFORNIA
60 WALKER STREET, NEW YORK 13, NEW YORK
36 NORTH CLINTON STREET, CHICAGO 6, ILLINOIS



Modern all-aluminum oil coolers of the oil-to-fuel type (left) and the oil-to-air type (right) employ all-brazed construction for maximum strength-weight ratio and highest resistance to temperature, pressure, vibration and wear.

Progress In Oil Coolers . . .

Based on unique, proprietary processes for producing and brazing thin metal sections, plus the largest wind tunnel laboratory facility of its kind, the Clifford Company has pioneered the major developments in this field since 1940.

As flight conditions become increasingly severe with the drive for higher speeds over greater altitude ranges, temperature regulation of engine lubricating oil becomes a critical, sometimes limiting, factor in aircraft capabilities.

The relatively simple requirements of oil cooling in pre-war reciprocating engines, have today become complex heat exchange problems further complicated by the need to provide adequate heat rejection capacity within strict limits of size, weight — and sometimes even shape.

Inert gas welding of reciprocating engine oil cooler.

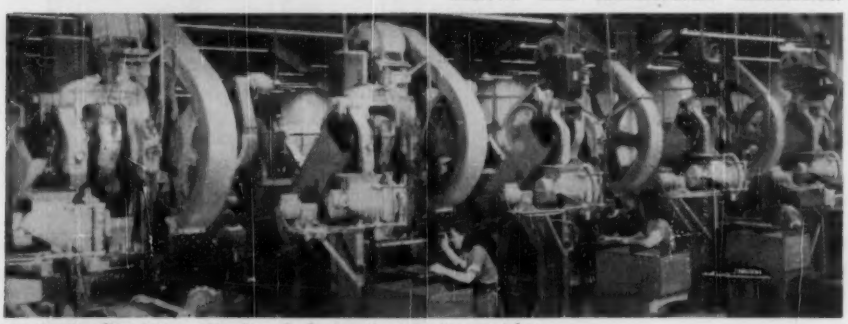
Three unique assets Clifford brings to bear on aircraft heat exchange problems have been largely responsible for the fact that it has initiated the major advances in the oil cooler field since 1940.

One asset is Clifford's ability to produce and fabricate thin metal sections, based on its own developments in deep drawing and extrusion.

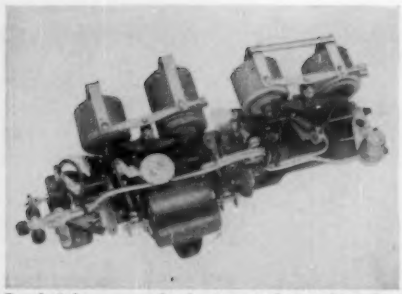
Another is its exclusive proprietary process for brazing thin metals — particularly aluminum — which is unmatched by any other process.

Third is Clifford's wind tunnel laboratory — the largest, most completely equipped technical facility of its kind.

Clifford's background since the company's inception in 1926 was in the manufacture of thin walled metallic bellows and thermostatic assemblies.



Production line impact extrusion of aluminum heat exchanger tubes.



Bombsight servomechanism is typical aircraft application of Clifford bellows for automatic compensation of changes in temperature, pressure and other factors

Typically, it broke into this field by developing the new, superior hydraulic forming method of producing bellows which today is the standard process throughout the world.

Handling thin metal sections to produce products for the control of heat proved excellent basic experience to back up Clifford's entry into the aircraft field.

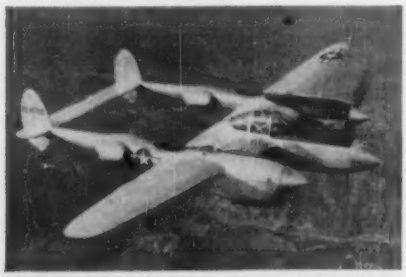
The deep drawing and extrusion process attracted the attention of the armed services in the pre-war preparedness days and Clifford was asked to produce copper tubes for the manufacturers of aircraft oil coolers and coolant radiators.

Once acquainted with the field, it was not long before Clifford's metallurgical background uncovered an area of opportunity. Copper coolers were not wholly satisfactory. The dip soldering method of fastening the tubes so annealed the metal that many failures were experienced at pressures of only 100 psi or less. With oil pressures trending steadily upward in the newer engines, the situation was right for the introduction of a better design if one could be found.

Five years of metallurgical research at Clifford had resulted in a unique, proprietary process for brazing thin aluminum sections. Combining its earlier development in deep drawing and extrusion of thin tubing, Clifford independently designed and produced the first all-aluminum oil cooler and coolant radiator.

The new unit weighed only one-third as much as conventional copper coolers and life cycle tests showed a far higher service expectancy. The air services gave their enthusiastic approval and Clifford found itself in the forefront of a new field.

First to use the new aluminum oil coolers and coolant radiators were the Air Force's P-40 and P-38. Others quickly followed. At the war's end, Clifford was the sole producer of all-aluminum oil coolers whose products had been combat tested.



Lockheed's famous P-38 was among the first military aircraft to use Clifford's newly developed all-aluminum oil coolers and coolant radiators.

Advertisement

Coolant radiator of the type used in wartime liquid-cooled reciprocating engines.

Early jet engines coming along after the war required no oil cooling device. Oil was simply sprayed on the bearings and then ejected overboard. But with General Electric's contract to produce the J47-C, Clifford was asked to develop a suitable cooling system.

A completely new concept of oil cooling was suggested by Clifford. Since jets consumed large amounts of fuel it was possible to pass cold fuel on one side of the heat exchanger, hot lubricant on the other. With the flow governed by thermostatic valves, the lubricating oil is kept at optimum temperature.

The new design, since it did not depend on ram air for cooling, could be mounted out of the air stream and more easily armored. These and other advantages caused it to be adopted as standard for military jet aircraft.

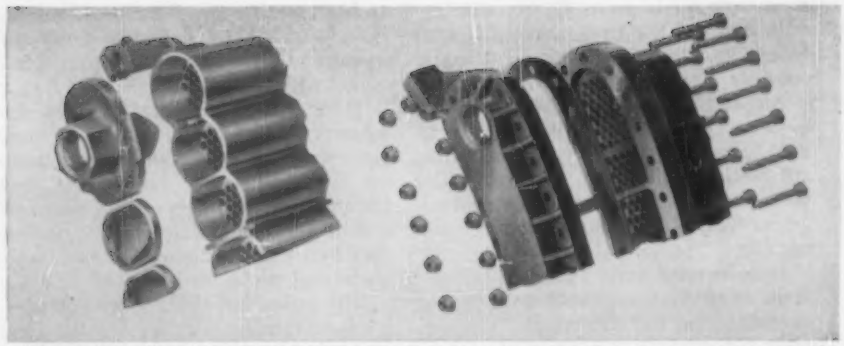
Later improvements resulted in substantial weight reduction and the elimination of numerous parts. Employing an extruded aluminum shell fastened by its proprietary brazing process, Clifford is today the only company able to produce these superior all-brazed, all-aluminum oil coolers.

Clifford's wind tunnel laboratory plays an increasingly important role in keeping the company in the forefront of aircraft heat exchanger developments. Ability to simulate service conditions with great accuracy eliminates the need for time consuming, expensive field testing of new designs. Its vast store of empirical knowledge permits rapid translation of thermodynamic theory into practical design without need for a succession of pilot models.

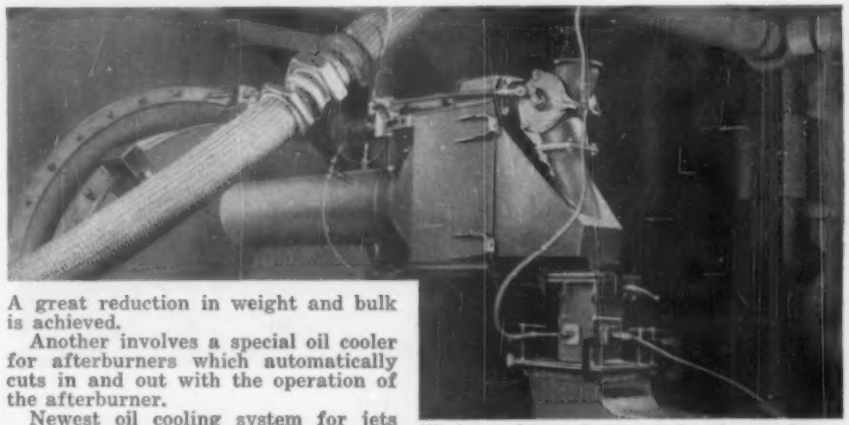
In few companies is there such a direct linear connection between research and production as can be found at Clifford.

New developments, still under military or proprietary wraps include a new oil cooler design based on using the latent heat of vaporization to cool the oil and vaporize part of the fuel before it enters the combustion chamber.

Sikorsky's H-39 helicopter which recently established a world's speed record, carries a Clifford oil cooler.



Advanced, simplified design of liquid type oil cooler for jet engines (left) shows obvious advantages over original design pioneered by Clifford. Gaskets, bolts and nuts are eliminated, weight reduced 28%, and a stronger, unitized, all-brazed construction achieved.



Wind tunnel test of air-to-air type heat exchanger assembly. Unit shown has integrally mounted control valves and actuator, and is used in aircraft air conditioning systems.

A great reduction in weight and bulk is achieved.

Another involves a special oil cooler for afterburners which automatically cuts in and out with the operation of the afterburner.

Newest oil cooling system for jets takes care of "high altitude cooling" conditions. When fuel flow drops too low to provide adequate cooling, thermostatic valves cut in an auxiliary air type cooler.

Helicopters pose especially difficult problems. Changes in direction from horizontal to vertical flight — or to hovering — makes their oil cooling demands highly variable. Clifford is currently developing two answers to these problems. One is an air-type cooler placed in an eductor. Engine exhaust is used to induce a flow of air for cooling. The second employs an air-type cooler placed in the air stream, but having in integral fan driven by a fluid motor. Oil temperature determines the operation of the fan through the action of thermostatic valves.

Rockets, missiles and avionic equipment are other areas in which Clifford is working. The company is also deep into nuclear energy heat exchange involving the handling of molten metals.

In all these areas, Clifford's unmatched facilities in aircraft heat exchange; and its unique ability to produce, fabricate and braze thin metal sections by proprietary processes is largely responsible for its present leadership in aircraft heat exchanger design.

For further information write: Clifford Manufacturing Company, 175 Ipswich St., Boston 15, Mass. *Division of Standard Thomson Corporation.* Offices in New York, Detroit, Chicago, Los Angeles and Waltham, Mass.

Bellows And Bellows Devices

CLIFFORD MANUFACTURING CO. WALTHAM, MASS.

Aircraft Heat Exchangers Valves Electronic Equipment

Self contained oil temperature regulating valves are designed and manufactured by Clifford for oil cooler applications.

Installation of oil-to-fuel type oil cooler on turbo-jet engine.

from 5 to 62 ft./min. By accurate coordination of the two, precise diagonal feeds are obtained. General Electric controls maintain speeds within 0.5%.

Although the North American and Simmons units differ in mechanical details, electrical circuitry and controls are basically the same. These are the work of Alan Davis, senior electrical engineer with NAA's Industrial Engineering Dept.

In all respects, North American's team tried to incorporate time-proven ingredients in the conversion. The GE electrical controls have proved out in numerous industrial applications; the Turchan follower for the miller's rise and fall mechanism, the Onsrud milling head, the Vickers hydraulic units and Minneapolis-Honeywell Microswitches, all are widely used.

Davis chose electrical components wherever possible—only the GE speed controls on the gantry and cutting heads are electronic. The "brain" that gives the machine its orders is built primarily around Automatic Electric Co. stepping switches—the basic units of the automatic dial telephone system.

The miller has three modes of operation—automatic, semi-automatic and manual. Its two-man crew—operator and his helper—are concerned mainly with watching the warning lights to make sure nothing is going wrong.

Sensitive followers riding longitudinally along the templates provide rise and fall information for the cutting heads. There is one follower and one set of templates for each cutter. The templates come in package form, one package providing the contours for an entire wing section. North American's engineers say this is the first time this has been done.

Cams on the templates tell the machine when only a short cutting pass is necessary, so the gantry can return the cutters to the starting point, saving the time that would be wasted if the machine continued its long horizontal travel over a wing part that required no cutting.

Morlath says that NAA has been using the same set of packaged templates on Super Sabre wing section for the past six months on a two-shift basis, and there is no reason to expect their replacement soon for loss of alignment. Cutters are replaced on completion of a wing section.

A "brain," containing stepping switches, tells the machine when it is time to move the heads transversely, and an index bar with accurately located pins controls the cross movement.

An interesting feature of the new millers is an angling chuck for moving the foot of the workpiece between machining steps. North American's engineers designed the integral stiffeners in the F-100 wing so that if their lines were extended they would meet somewhere in space beyond the end of the wing. Translating this design into practice could be tricky and time-consuming on an automatic machine. The angling chuck does it all automatically, by placing the work at various preset angles with relation to the cutting heads which continue their longitudinal travel parallel to the machine's ways.

This conversion, while a big job, is not the largest Simmons has handled. During World War II, the company rebuilt two 990,000-lb. gun lathes for Bethlehem Steel Corp. These had been stored since the end of World War I, but were put into operating condition in three months. New lathes would have taken a year or longer to build.

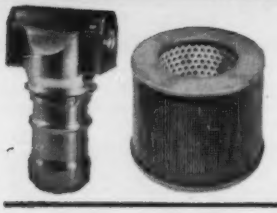
Simmons has more than 200 machines tools of its own, of various types, which it uses for rebuilding, conversion and its own production products. The company's home-built surface grinder, believed to be the largest in the world, was used to machine the ways for the new NAA skin miller.

Simmons was founded in 1910 by Charles A. Simmons, now chairman of the board. His son, C. A. Simmons, Jr., is president. Present employment is over 300 and last year's gross was around $2.5 million.

Bendix-Skinner

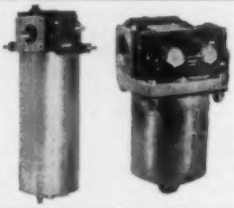
FINER AIR-BORNE FILTERS

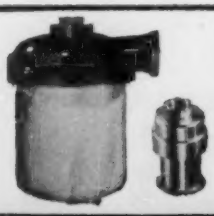
FOR EVERY PLANE AND PURPOSE



Hydraulic Complete filters, or elements only. Up to 14,000 p.s.i. burst, to 120 g.p.m., and filtration down to ½ micron*. Efficiency to 99.9%. (MS28720-4, -6, -8, -12; AN6235-1A, -2A, -3A, -4A; AN6236-1, -2, -3, etc.)

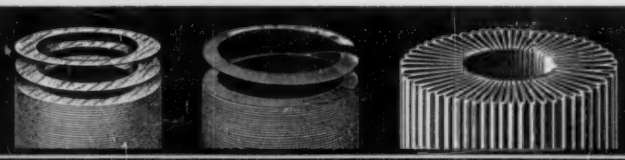
Fuel Flow from 3 P.P.H. to 30,000 P.P.H. Housings up to 2,000 pounds operating pressure. Complete range of filtration from ½ micron to 200-mesh screen (74 microns).





Air Instrument air and breather filter application to 10 c.f.m. Filtration for air-driven instruments and venting of hydraulic systems. (AN6240-1, AN5822-1, AN-6237-1, etc.)

*1 MICRON = .000039"



Disc-type Ribbon-type Pleated-type

BENDIX-SKINNER DIVISION OF Bendix AVIATION CORPORATION

P.O. BOX 135, ROYAL OAK, MICHIGAN

Export Sales: Bendix International Division, 205 East 42nd Street, New York 17, N. Y.

ORIGINATOR OF **MICRONIC** FILTRATION

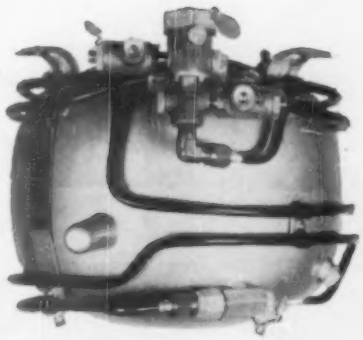
THE SLEEK NEW USAF MARTIN B-57 TACTICAL BOMBER IS EQUIPPED WITH THE ARO 5 LITER LIQUID OXYGEN CONVERTER

ARO *Vision-eering*

LEADS THE WORLD IN OXYGEN EQUIPMENT

Another ARO FIRST! The new 5, 8 and 20 Liter Liquid Oxygen Converters developed by ARO trim the space-and-weight load in fighters and bombers . . . for example, crew oxygen increases by 75% over equivalent gaseous oxygen supply at no expense in weight. Complete technical and engineering data available on request.

This is typical of many ARO contributions to aviation progress . . . with world leadership in the design, development and manufacture of oxygen equipment. Leading aircraft builders today depend on Aro for a growing number of precision products. For further details write:



THE ARO EQUIPMENT CORP. • BRYAN AND CLEVELAND, OHIO

Aro Equipment of California, Los Angeles, Calif.
Aro Equipment of Canada, Ltd., Toronto 15, Ontario
Offices in All Principal Cities

ARO ®

AIRCRAFT PRODUCTS

Liquid Oxygen Converters, Oxygen Regulators, Pressure Regulators, Contents Gauges, Relief Valves "Anti-G" Valves, Air and Oxygen System Accessories, Actuating Cylinders, and other Aircraft Accessories.

Beech Should Reach Jet Decision By Fall

By Erwin J. Bulban

Beech Aircraft Corp. could roll out the first U. S. production version of the twin-jet Morane-Saulnier MS-760 business plane in one year, says Jack Gaty, vice president-general manager. The new 400-mph., four-place executive plane will cost approximately $300,000, according to Beech officials.

Indications are that the company should be able to reach a decision on MS-760 production by this fall, based on customer reaction during the nationwide U. S. and Canadian tour which began early this month in New York. Beech has a working arrangement with the French airframe builder to evaluate the Western Hemisphere market and an option to build the airplane (AW May 9, p. 22).

ABOUT $300,000 is price Beech is tentatively quoting for its version of twin-jet MS-760.

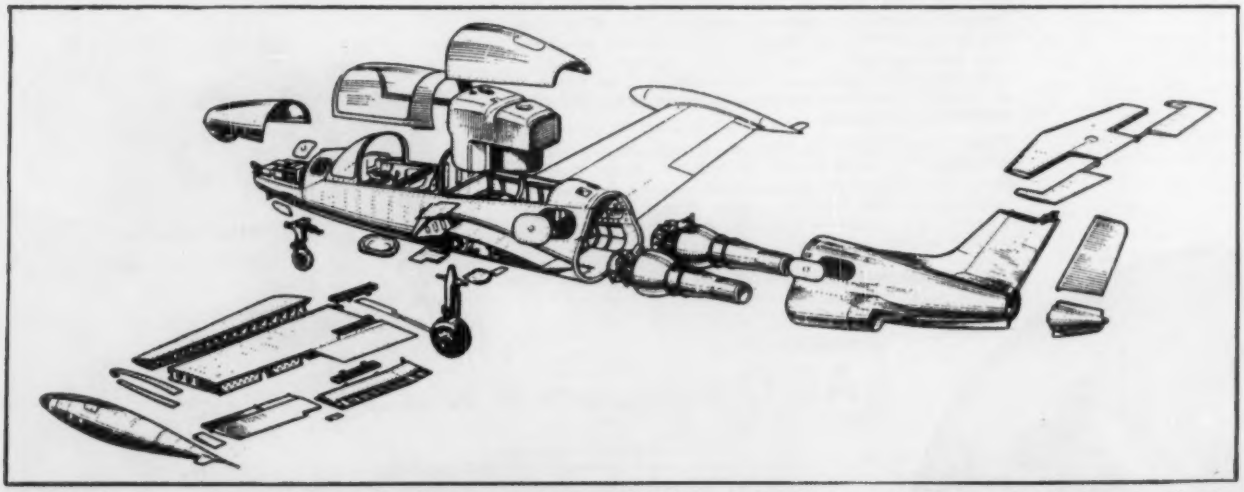
Civilian Market

Countering a report that Beech would expect more than 100 commercial orders before it would put the airplane into production, a company official told AVIATION WEEK that he believes such a decision would be made on the basis of considerably fewer initial orders, although he declined to discuss numbers. He said the company feels it is going to have a free field in this category airplane for some three or four years and could go on the basis of a gradual buildup.

During this period, Beech implies it would take advantage of the considerable growth factor it sees in the design. The current airplane is powered by twin Turbomeca Marbore 2s rated at approximately 880 lb. thrust each. The Beech airplanes would be powered by Continental-built Marbores of approximately 900 lb. thrust and the U. S. engine builder reportedly has improved versions in the mill developing 1,200-1,500 lb. thrust. These later engines also promise improved specific fuel consumption over present French engines.

The French government has given the MS-760 commercial approval. The U. S. does not yet recognize French type certification, although initial contact has been made by the two governments on this matter. Civil Aeronautics Administration says that such arrangements take a minimum of a year and a half.

Beech states that the civilian market will get first priority in its demonstrations. From New York the itinerary includes Washington, D. C., where U. S. and foreign military personnel will be invited to inspect the airplane, then Atlanta, Houston, Wichita, Denver, Albuquerque, Los Angeles, San Francisco, Seattle, Detroit and Chicago.



ACCESSIBILITY IS KEY FEATURE of French-designed jet. Ten MS-760 mechanics have completely disassembled plane in 23 min., put it together in 50 min., after which it went through a flight demonstration. Four men can change both engines in about 50 min.

The tour will radiate from these stops to neighboring cities.

Canadian phase of the tour will cover Montreal and Toronto for civilian showing and Ottawa and Trenton for viewing by Royal Canadian Air Force. Then the airplane will go to Pensacola for approximately 200 hr. of flight demonstrations (AW May 23, p. 7).

U. S. Navy has exhibited considerable interest in the plane. Last year Beech officials visited Paris following the SBAC show in Farnborough and were told by high-ranking Navy personnel that the MS-760 is "really outstanding" and were urged to look at it.

Beech sees no difficulty in getting the airplanes to civilian customers if Navy should place orders for a military trainer version. The company points out that it has been sandwiching military and civilian production at its Wichita plants for several years. They say the only time a problem arose was during the Korean emergency when Beech stopped Twin-Bonanza civilian output and diverted this production to the Army.

Flight Characteristics

During a press demonstration at Westchester County Airport, the plane went aloft for 20 minute flights with Jean Cliquet, Morane-Saulnier's chief pilot, and Allen Raines, of Beech Aircraft's sales department, a military reserve jet pilot who is learning how to handle the plane.

Starting the airplane seems to be simple. The fuel cock is fully depressed and igniter button is pressed. When the tachometer hits 5,000 rpm., the starter is released, halting starter fuel injection into the combustion chamber and automatic fuel metering system takes over. Procedure is repeated for the other engine.

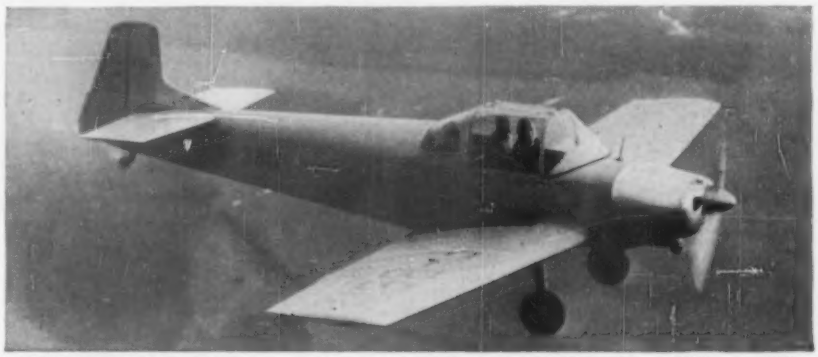
Stabilizer is usually trimmed one-half deg. nose up for takeoff, other trim at neutral. Raines told AVIATION WEEK that he generally uses about 17-deg. flaps for takeoff. Canopy is closed and a lever on the right side is pushed forward to inflate the canopy seals, for pressurization.

Takeoff is at about 22,600 rpm. The stick is eased back at approximately 70 kt. and the airplane leaves the ground at about 85-90 kt. The plane is leveled out shortly after takeoff at about 100 kt. and flaps are retracted at 105 kt. Fully loaded the MS-760's best climb speed from sea level is 230 kt. Normal cruise altitude is 21,000 ft.

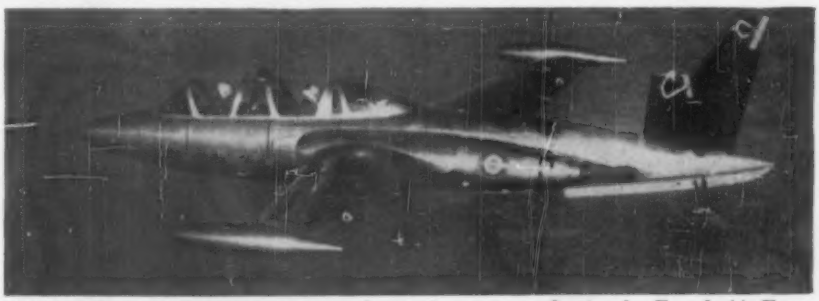
Fuel management is going to be an important aspect of future jet business plane operation, Raines points out. The MS-760, for example, burns 90 gal./hr. idling at Westchester's 430-ft. elevation. Fuel consumption at normal cruise altitude of 21,000 ft. is 2.01 gal./min., giving a range of 740 mi.; but at 3,000 ft.,

French Variety in Lightplanes

DRUINE TURBULENT single-seater (foreground) has 25-hp. engine. It weighs 500 lb. and does 90 mph. Two-seat Turbi, in rear, weighs about 1,100 lb. and does 100 mph. on 50 hp.



DURINE CONDOR cabin two seater weighs 1,100 lb. and can take either a 65-hp. or 90-hp. Continental engine. It has a top speed of 112 mph. on 65 hp. Condor's wingspan is 30.2 ft.



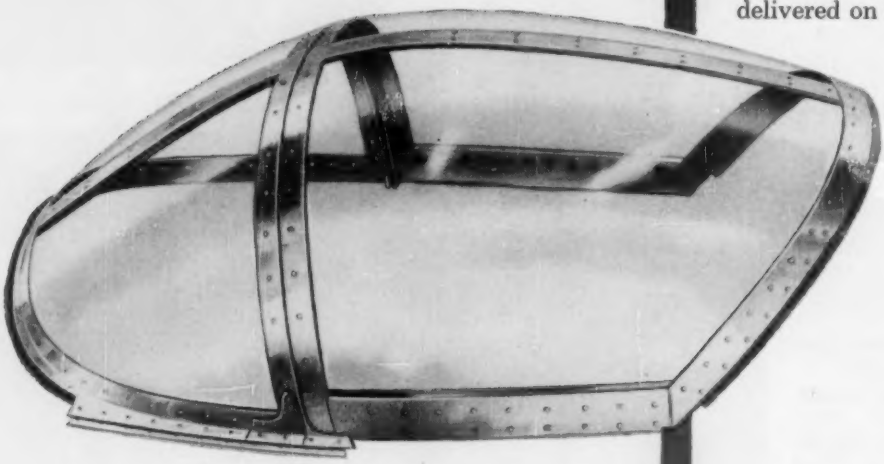
FOUGA 170-R MAGISTER twin-jet tandem trainer is in production for French Air Force, does better than 450 mph. on 880-lb.-thrust Turbomeca Marbores. Gross weight is 6,160 lb.

JODEL D.3 side-by-side two-seater has a top speed of 124 mph. on 75 hp. Gross weight is about 1,100 lb. Like the Durines above, the Jodel is designed for "build-it-yourself" addicts.

Kawneer "package" service provides economy in Cessna Cockpit enclosure

Kawneer provides quality, economy and delivery again! Last Fall Kawneer started the Cessna T-37 side-by-side cockpit enclosure project and delivered the first unit this Spring. This "on schedule" procedure was possible because Kawneer has formed an integrated "package" of engineering, design and production in the cockpit enclosure field.

As specialists working with acrylics and metal in the production of cockpit enclosures, Kawneer offers you quality products, economically produced and delivered on time.



KAWNEER'S Package for Cessna Included:
Engineering, Design, Stress Analysis, Weight Analysis, Tool Design, Tooling, Static Testing, Complete Production including Acrylics Forming and Metal Work.

Write for new book illustrating Kawneer's integrated "package" program

Kawneer
General Offices
NILES, MICHIGAN
AIRCRAFT PRODUCTS DIVISION

fuel consumption climbs to 3.60 gal./min. and range drops to 490 mi.

The airplane has a critical single-engine performance until airspeed gets to 105 kt.

Currently the demonstration MS-760 uses Shell JP-1, which is short in supply in the U. S., because it has been phased out of jet operations. JP-1 is available in limited quantities in the New York area. Nearest fuel grade is Shell kerosene 640 which the petroleum firm is producing for Capital Airline's turboprop Viscounts.

While aloft, Raines cut an engine, leaving it to windmill while he picked up power on the remaining Marbore, then a couple of minutes later restarted the dead engine. Yaw with one engine out was only a few degrees and hardly noticeable.

On the next flight, with another pair of passengers, the port engine gave out with some "funny noises" when Raines attempted a restart, so he came back to the airport on one engine, without difficulty, he said. Detailed examination revealed failure of the front bearing. Morane-Saulnier brought six spare Marbores to the U. S. Two engines can be changed by four men in about 50 min.

Perforated dive brakes above and underneath the wings are activated by a button on the right throttle or a handle on the port side of the windshield. Popping them open causes no noticeable nose pitching.

Best approach speed is approximately 95-100 kt. and touchdown is made at about 85 kt.

PRIVATE LINES

Beech officials see Germany as an important market for U. S. business planes. A number of German concerns have been operating executive planes using Swiss-registered aircraft and pilots.

Convair expects to sell soon several business plane versions of its 340B, improved 340 with additional soundproofing, quieter exhausts, and 5 mph. faster. Company feels that there is a current market for at least 10 airplanes.

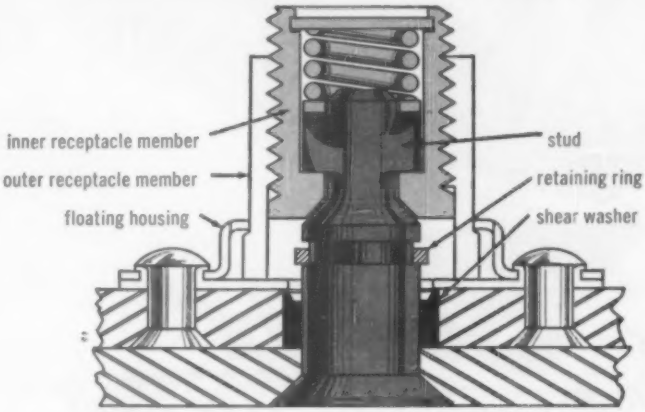
First Bell executive 47H-1 copter has been delivered to the president of Colombia, Gen. Gustavo Pinilla.

National Business Aircraft Assn. will administer award of the Women's Aeronautical Assn.'s annual Business Flight Safety Trophy to that person in industry who has most effectively carried out and promoted safety. Trophy will be given to nominee at NBAA national convention.

New High Performance Fastener

EXCEEDS ULTIMATE TENSILE and SHEAR LOADS OF NAS 547

New PANELOC High Performance Aircraft Fastener Carries Primary Structural Loads in Shear and Tension with Minimum Deflection and Minimum Sheet Separation.



Patented and Patent Applied For

Announcing high strength, quick release, rotary type fastener for advanced aircraft designs. Available in stud-retained and curvature adaptable types, in sizes 1 & 2 with full float as specified by NAS 547. Opens and closes with quarter turn, stud ejection shows unlocked condition. Easily pressure sealed. Adjustable for sheet pick-up in accordance with NAS 547, thus simplifying stud inventory. Catalog and price list belong in your file. Send request today.

PANELOC...America's most versatile line of aircraft fasteners . . . High Performance Fasteners, Styles 1, 2, & 3 Panel Fasteners, Rotary Latches, and Snap Fasteners.

Fill in Coupon or Write Letter for Catalogs

Scovill Manufacturing Company, Aircraft Fastener Div.
43 Mill Street, Waterbury 20, Connecticut
Please send me fastener catalogs checked:
( ) High Performance (NAS 547) ( ) Style 3 (MIL-F-5591A)
( ) Styles 1 & 2 (MIL-F-5591A) ( ) Rotary Latch
( ) Snap Fasteners (AN227)
Send to:
Name_____ Title_____
Company_____
Address_____

Bendix Red Bank

TYPE 30E16 DC GENERATOR

With its 30-volt, 100-ampere rating, the Type 30E16 offers increased output and reliability that make it the ideal replacement for existing 50 and 75 ampere aircraft generators. In most cases, it can be used with existing control equipment—with types 1042-17 and 1589-1 voltage regulators, for example.

This generator can be furnished with either square or round mounting flange and is suitable for use on Continental R9A, P & W 985, P & W 1340, P & W 1830 and Wright GR 1820 engines.

For military applications, the generator conforms to AF Drawing 52B-6588 and will deliver full output at 35,000 feet altitude and 75% rated power at 50,000 feet.

CHARACTERISTICS

Speed	2500-4500 rpm
Min. Speed for Regulation	2500 rpm
Max. Speed for Regulation	5500 rpm
Power	3000 watts
Min. Air Blast Pressure	6 in. water
Weight	39.5 lbs.

For complete information about Bendix Red Bank Generators . . . both DC and AC . . . write us today.

Bendix Red Bank
EATONTOWN, N. J.

DIVISION OF Bendix AVIATION CORPORATION

West Coast Sales and Service: 117 E. Providencia Ave., Burbank, Calif.
Canadian Distributors: Aviation Electric Ltd., P.O. Box 6102, Montreal, P.Q.
Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

USAF Contracts

Following is a list of recent contracts announced by the United States Air Force:

Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron, Ohio, hose, acetylene, 3/16 in., 6200 ft., ¾ in. ID, 19,500 ft., 5/16 in. ID, 36,800 ft., ¾ in. ID, hose, air, 350,000 ft., 3/16 in. ID hose, oxygen, type 2, 43,900 ft., $30,650.

Welsh Manufacturing Co., 9 Magnolia St., Providence 9, Rhode Island, lens, flying sun glasses, neutral, 25,000 pr., lens-goggle welder, 495 pr., $31,448.

AiResearch Mfg. Co., 9851 Sepulveda Blvd., Los Angeles, kits for type GH-4 ground heaters, $360,238.

Firestone Tire & Rubber Co., 1200 Firestone Parkway, Akron, Ohio, services to retread 04C aircraft cashings, call contract.

Lite Mfg. Co., Inc., 101 W. 21st St., New York 11, helmet, flying, seal brown; sheepskin outer shell, lambskin lining, throat strap with adjustable buckle with snaps; consisting of earphone headset; small size, 181 ea., medium size, 2,228 ea., large size, 6,262 ea., extra large size, 3,371 ea., $587,-167.

Howard Steel Fabricating Corp., 1221 S. Plate St., Kokomo, Ind., steel bar, 132,671 lb., $31,317.

Bliss and Laughlin, Inc., Harvey, Ill., steel rod, 219,960 lb., $25,482.

Carbide and Carbon Chemical Co., Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y., fluid, 520,990 gal., $397,106.

Fairchild Aircraft, Hagerstown, Md., lock, wrench, 1,446 ea., $138,468.

Olympic Screw and Rivet Co., 11406 S. Downey Ave., Downey, Calif., rivets, 2,625,-400 ea., $27,020; rivets, 3,762,000 ea., $59,-396.

David Clark Co., Inc., 360 Park Ave., Worcester 2, Mass., coverall, high altitude, type MC-1, 2,011 ea. $452,475; gloves, pressurized for use with MC-1 coveralls, 2,011 pr., $38,209.

Skyline Clothing Corp., 424 Central Ave., Peekskill, N. Y., coverall, flying men's, sage green, 53,211 ea., $463,047.

H. I. Garment Co., 6156 Cottage Grove, Chicago 37, coveralls, anti-G, type MB-2, 5,000 pr. $260,386.

David S. Neal, d.b.a. Neal Machine & Tool Co., 1400 E. Kibby St., Lima, Ohio, jack, hand hyd., 10-ton cap., folding tripod, type B-6, 240 ea., $99,343; spare parts, 1 lot, $2,731.

Virginia Dyeing Corp., 10 E. 32nd St., New York 16, dyeing of cloth, nylon, 326,-100 yd., $31,677.

Goodyear Tire & Rubber Co., Inc., Akron 16, Ohio, services to retread 04C aircraft casing, call contract.

B. F. Goodrich Co., Industrial Products Div., 500 S. Main St., Akron, Ohio, matting, rubber, 551,562 sf., $83,120.

United States Rubber Co., 1 Market St., Passaic, N. J., hose, acetylene, 1,600 ft., hose, aircraft, flame resistant, 1 in. ID, 32,-900 ft., hose, aircraft, flame resistant, 1¼ in. ID, 26,500 ft., hose, aircraft, flame resistant, 1½ in. ID, 17,300 ft., hose, aircraft, flame resistant, 1¾ in. ID, 2,200 ft., hose, aircraft, fuel oil, coolant, water and alcohol, ⅜ in ID, 21,400 ft., hose, aircraft, fuel oil, coolant, water and alcohol, ⅜ in. ID, 250 ft., hose, aircraft, hydraulic, pneumatic, fuel, oil, and coolant resistant, ¼ in. ID, 21,300 ft., $52,-960.

Raybestos-Manhattan Inc., Manhattan Rubber Div., 61 Willett St., Passaic, N. J., hose, aircraft, flame resistant, ¼-in. ID., 16,-800 ft., hose, aircraft, flame resistant, 5/16 in. ID. 4,500 ft., hose, aircraft, flame resistant, ⅜ in. ID. 10,200 ft., hose, aircraft, flame resistant, ½ in. ID, 11,700 ft., hose aircraft, flame resistant, ⅝ in. ID, 7,000 ft., hose, aircraft, flame resistant, ¾ in. ID, 12,-700 ft., hose, aircraft, flame resistant, 1 in. ID, 4,900 ft., hose, aircraft, fuel oil, coolant, water and alcohol, ¼ in. ID, 40,200 ft., hose, aircraft, fuel, oil, coolant, water and alcohol, 5/16 in. ID, hose, aircraft, fuel, oil, coolant, water and alcohol, ⅜ in. ID, 24,400 ft., hose, aircraft, fuel, oil, coolant, water and alcohol, 1¼ in. ID, 32,700 ft., $38,999.

AEROQUIP ENGINEERING SERVICE HELPS CONVAIR Save Weight ON THE F-102A

Why not take advantage of Aeroquip weight saving hose lines and start-to-finish engineering service? Write for information.

Objective 1: *Reduce weight of existing plumbing.*

Result: When conventional hose types were replaced with Aeroquip 601 lightweight engine hose, and 617 lightweight air frame hose, a weight saving of approximately 23% was achieved.

Objective 2: *Reduce item quantity.*

Result: Aeroquip engineers assisted in replacing 86 items such as hose assemblies, jamb nuts, and bulkhead adapters with only 70 items including straight AN adapters.

Objective 3: *Simplify the plumbing system.*

Result: 14 possible points of leakage, as defined by screwed connection of AN adapter to AN swivel nut, were eliminated. Small bends, made possible by the great flexibility of Aeroquip 601 lightweight engine hose, improved installation.

Aeroquip

REG. TRADEMARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN
AERO-COUPLING CORPORATION, BURBANK, CALIFORNIA
(A Subsidiary of Aeroquip Corporation)

Manufacturers of Aeroquip Flexible Hose Lines with detachable, reusable Fittings; Self-Sealing Couplings; Brazed Aluminum Elbows
LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U.S.A. AND ABROAD • AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

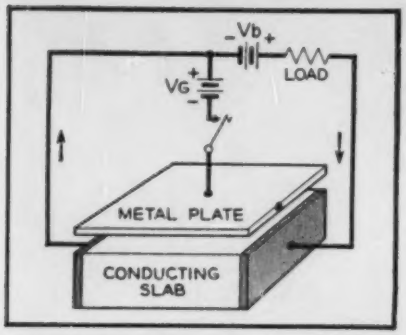


FIG. 1. Schematic representation of a field-effect transistor in a circuit designed to illustrate how current through the slab can be controlled by applying a voltage to the metal plate.

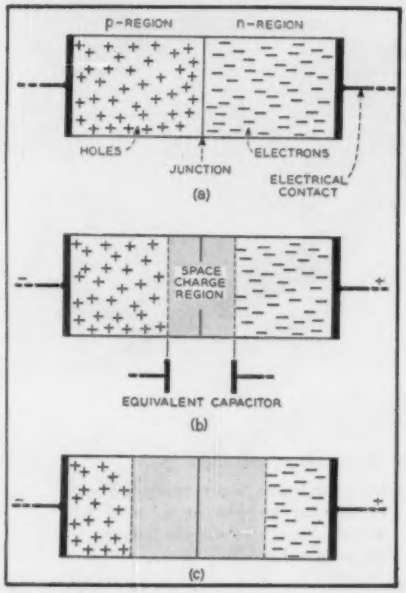
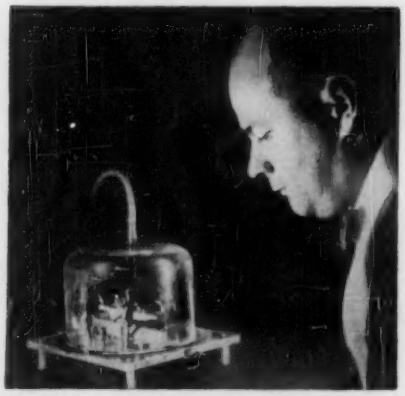


FIG. 2. Distribution of holes and electrons in a p-n junction for: (a) no bias voltage applied; (b) a reverse bias where removal of charges produces a space-charge region and makes the junction equivalent to a capacitor; (c) a large reverse bias producing a wider space-charge region.



HEATER used in fabricating transistor.

Field-Effect Transistor Raises Semiconductor Frequency Range

By I. M. Ross

The "field-effect" transistor is one of the latest additions to the transistor family.

Although it operates on a principle quite different from that of the point-contact or junction type, it is capable of performing many of the same functions such as amplification or oscillation, and it has the advantages of small size and low power consumption common to the others.

The development of the field-effect transistor is in an early stage; however, it has already been shown that it behaves as predicted by theory and, in particular, that it should eventually be capable of operating at appreciably higher frequencies than can the point-contact or usual junction type.

It is the possibility of obtaining this higher frequency response that is the most interesting feature of the field-effect transistor.

Underlying Principle

Although the field-effect transistor is one of the most recent of the transistor family to be made into a practical amplifier, the underlying principle is quite old as transistors go. The original proposal for the device is illustrated in Figure 1.

As shown, it consists of a thin sheet of conducting material with electrical contacts at each end and a metal plate close to, but not in contact with, one surface. The surface of the conductor and the metal plate then form a capacitor. By applying a potential to the plate, a field will be set up in the conducting slab and, if the polarity of the potential is correctly chosen, this field will tend to push the current carriers away from the surface of the material. The net result of this will be a decrease in the total number of carriers in the material and hence an increase in the resistance from end to end of the slab.

If the device is connected as shown in Figure 1, when the key is closed, the current through the slab will decrease. It is therefore possible to control the current through the slab by means of the potential on the metal plate and, if the dielectric between metal and slab were perfect, this control would require no power. In the circuit of Figure 1, the current through the slab also flows through a load resistor. Thus, when the current changes, the potential drop across the load resistor changes and, if a large enough resistance is used, this potential change will be greater than that applied to the metal plate. In other words, it would be possible to obtain voltage amplification.

Also, when the current in the load changes, the power dissipated in it will change and, since the control power is essentially zero, there would be power amplification.

The principal problem in the realization of the field-effect transistor was to find a suitable material for the slab.

Since the material had to be a conductor, all insulators were immediately ruled out.

Metals, on the other hand, contain such high densities of current carriers —electrons—that it would require an impractically high potential to give an appreciable percentage change in the current flowing.

Semiconductors, however, have densities of current carriers lying between those of insulators and those of metals and are ideally suited as "field-effect" transistor materials. In 1948, W. Shockley and G. L. Pearson of Bell Telephone Laboratories used germanium to make a structure similar to that shown in Figure 1. They found that they were able to affect the current through the germanium by means of the potential on the metal plate, but that the control sensitivity was much less than that predicted from a theory of the device. However, this was the first time that the "field-effect" mechanism had been observed.

Loss of Sensitivity

It was proposed by J. Bardeen that the loss of sensitivity of the device could be attributed to conditions at the surface of the germanium slab. At the surface, the arrangement of atoms is different from that in the bulk of the material, and hence the electrical properties may also be different.

In effect, what Bardeen proposed was that the free surface acted as an electrical screen that tended to prevent a field from penetrating into the body of the material, thus decreasing the effect of the field on the resistance of the slab. It was during an investi-

The author is engaged in physical research at Bell Telephone Laboratories. He holds a Ph. D. from Cambridge University.

gation to test this hypothesis that Bardeen and W. H. Brattain invented the point-contact transistor.

The field-effect transistor in its original form lacked sensitivity because of the effect of the germanium surface. The ideal would be to have a capacitor situated inside the germanium slab to eliminate surface effects. This can be achieved by using what is called a p-n junction.

In a semiconductor like germanium, there are two important ways in which conduction can occur:

In the first, conduction takes place by the movement of electrons, which, being negatively charged, move in a direction opposite to the electric field. A semiconductor in which conduction is due primarily to the movement of electrons is called "n-type," the "n" standing for negative.

In the second type, conduction is due to the movement of what are called "holes," which may be considered as particles having almost the same mass as that of an electron but having a positive charge. Hence, holes will move in the same direction as the electric field. A semiconductor in which conduction is due primarily to the movement of holes is called "p-type," the "p" standing for positive. It is possible to make germanium either n- or p-type, depending on the chemical elements added during growth of the crystal.

P-N Junction Transistor

A p-n junction specimen may be defined as a piece of single-crystal semiconductor containing two regions, one having n-type conductivity, and the other p-type. The boundary at which the type of conductivity changes is referred to as "the junction."

Such a p-n junction is shown in Figure 2(a), where the distribution of current carriers (holes and electrons) are represented schematically by the plus and minus symbols. If the p-side is made positive with respect to the n-side, then electrons will be pulled across the junction from the n- to the p-region, while holes will move in the opposite direction. Because of the motion of these charges, a current flows, and this current increases with increasing applied voltage. Under these conditions, the junction is said to be biased in the "forward" direction, and it has a low impedance.

If, however, the p-region is made negative with respect to the n-region, both the electrons and holes are pulled away from the junction, and little or no current flows across the junction. Under these conditions, the junction is said to be biased in the "reverse" direction and it has a high impedance.

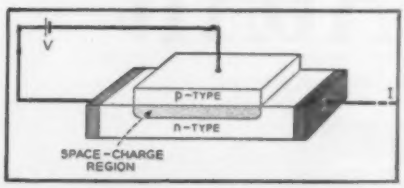


FIG. 3. Field-effect transistor using a p-n junction to produce a 'capacitor' within the body of the semiconductor. A voltage that is applied between the p- and n-type material causes a penetration of space charge, creating a region within the body of the n-type material that will not contribute to current flow through semiconductor.

Reverse Bias

A rigid analysis of a p-n junction biased in the reverse direction shows that there is a small but constant current flowing, in the order of a few microamperes.

This current is independent of the magnitude of the applied bias and is therefore called the "saturation" current. The analysis further shows that all the voltage drop occurs in a region close to the junction itself. In fact, the electric field in that region is sufficiently high to pull all the charged carriers (electrons and holes) out of it.

This situation is shown in Figure 2(b) where the charged carriers have been removed from a region on either side of the junction. Such a region is called a "space-charge" region. Since it contains no current carriers, it cannot support conduction and will, therefore, act like an insulator. However, this region is bounded by conducting regions of p- and n-type conductivity.

A p-n junction biased in reverse is, hence, equivalent to a capacitor with plate separation equal to the total width of the space-charge region as shown in Figure 2(b). If the voltage across the ends of the junction is increased, Figure 2(c), the charged carriers are pulled farther from the junction, increasing the width of the space-charge region and, thereby, increasing the plate separation of the equivalent capacitor.

Thus, as the reverse voltage across a p-n junction is increased, the capacitance of the junction should decrease.

The p-n junction has the desired properties for use in a field-effect transistor, and Figure 3 shows the junction equivalent of the elementary field-effect transistor. Such a unit could be used as an amplifier. However, there is a more interesting and useful form of the transistor shown in Fugure 4(a). This device, as shown, has an n-to-p junction on both sides of an n-type slab, and the two p-regions are connected.

Consider what happens if the p-regions are short circuited to the left end of the n-region and a positive potential applied to the right end, Figure 4(a).

A current, I, will flow in the direc-

ASSEMBLING transistor in special jig.

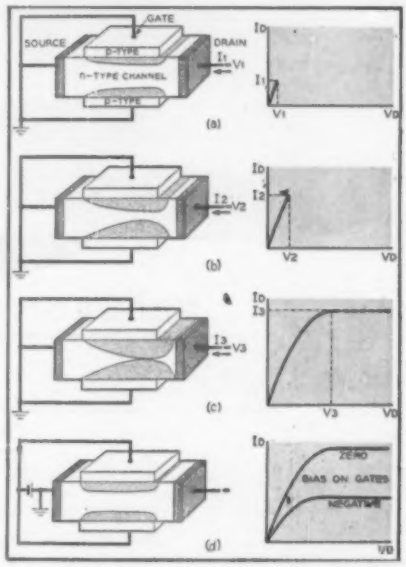


FIG. 4. Schematic diagrams of a field-effect transistor, showing the shape of the space-charge region and current-voltage characteristic for: (a) zero gate voltage and small drain voltage; (b) larger drain voltage; (c) pinch-off condition for zero gate voltage; (d) voltages applied to both gate and drain.

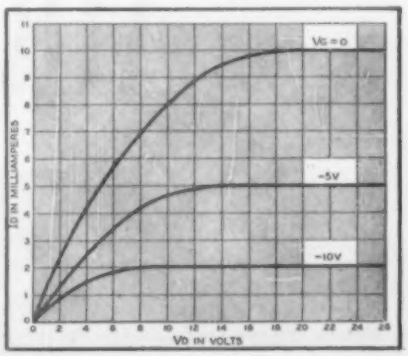
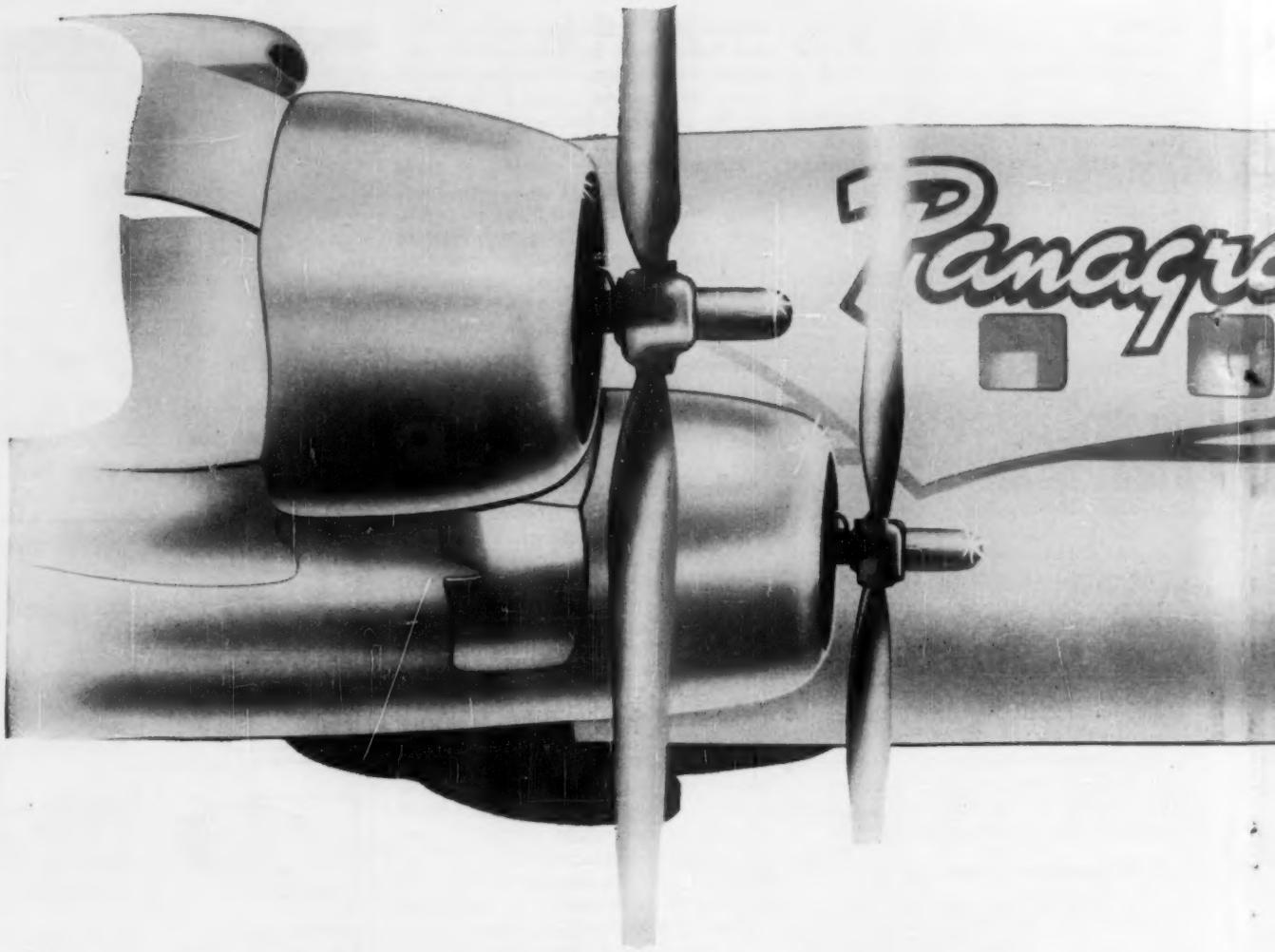


FIG. 5. Theoretical characteristic curve for field-effect transistor with gate voltage as the parameter.

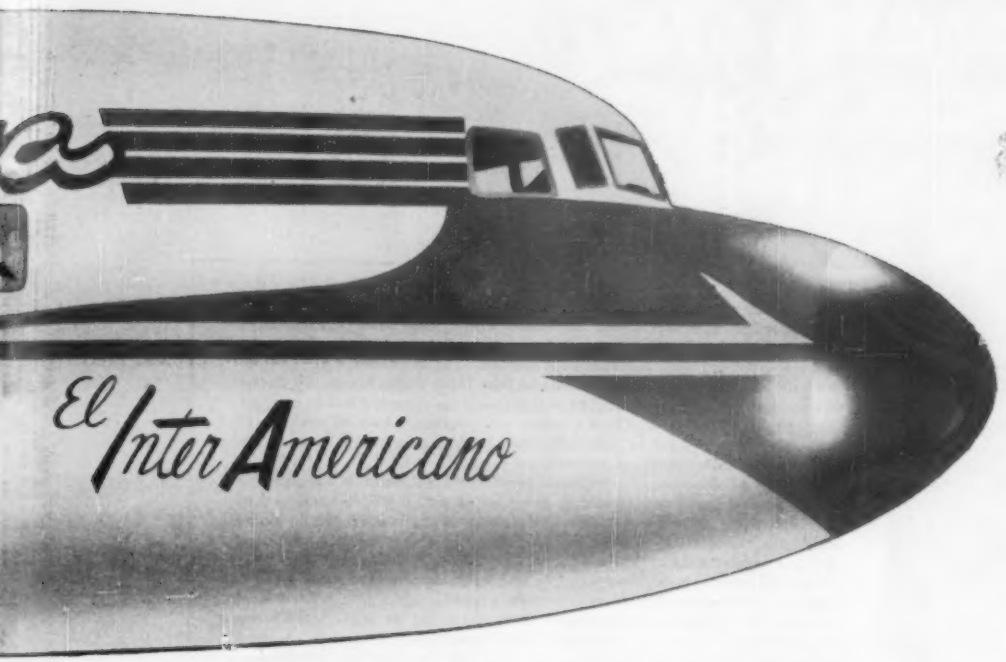


BENDIX

AIRBORNE RADAR

AIR COMMUNICATIONS AND NAVIGATION EQUIPMENT • AIR DEFENSE RADAR • GROUND CONTROLLED APPROACH AIRCRAFT LANDING SYSTEMS • MISSILE

West Coast Sales: 10500 Magnolia Blvd., N. Hollywood, Cal., Export Sales & Service: Bendix International, 205 E. 42nd St., N.Y. 17, N.Y., U.S.A., Canadian Distr.: Aviation Electric,



World's first airline to use airborne radar in scheduled flight... *and the radar is by Bendix!*

Panagra is using, on scheduled flights of its new DC-7 fleet, the latest major contribution to safe, more comfortable commercial aviation . . . Bendix* Airborne Radar.

It's Bendix Airborne Radar that gives Panagra pilots a long distance, all seeing, extra "eye" for avoiding turbulence. This radar is also used for terrain mapping and navigation.

Storm Avoidance

Bendix Radar detects and sees through turbulence up to 150-miles away . . . even at night or under instrument conditions. It penetrates heavy rainfall and reveals smooth corridors through apparently solid storm areas. The naked eye can't see the quiet paths . . . but radar can.

With a slight detour from track, at cruise powers, storm avoidance means improved flight schedules . . . minimized flight course detours, few flight cancellations, more completed flights.

Now Panagra passengers will enjoy smoother flying . . . greater comfort . . . guided through turbulent areas by Bendix Radar behind the radome . . . soon to become the most famous nose in aviation.

"C" and "X" Band Radar

Bendix is *the only* manufacturer offering both C and X band radar. Send for free illustrated Bendix booklet, "Airborne Storm Avoidance Radar Systems."

Bendix Radio
DIVISION
BALTIMORE 4, MARYLAND

Bendix
AVIATION CORPORATION

*Reg. U.S. Pat. Off.

SILE GUIDANCE • AIRBORNE RADAR
ric, 200 Laurentian Blvd., Montreal, Que.

● FOR FLIGHT TEST INSTRUMENTATION

PRECISION SUBCARRIER DISCRIMINATOR

• FOR MULTIPLEXED FREQUENCY MODULATED INSTRUMENTATION SYSTEMS

Performance obtained from EMR's new Model 67 Precision Subcarrier Discriminator indicates that it will supersede existing subcarrier discriminators used in frequency modulated telemetering and data recording systems, and will establish new standards for systems now in design.

The new instrument incorporates a Band Pass Input Filter, Frequency Determining Network, and an interchangeable Low Pass Output Filter in a single front panel plug-in unit. Three outputs are provided, one of which will drive most pen motors to full deflection. Each discriminator contains its own electronically regulated power supply.

The Model 67 Discriminator is linear within 0.1%, slope is constant to ±0.25%, and long-term zero drift does not exceed 0.5% (all referred to full bandwidth). Wide range base line limiting of the subcarrier eliminates amplitude modulation effects and reduces the effect of step function changes encountered in magnetic tape dropouts to a minimum.

Of special interest is the fact that this discriminator provides constant time delay of intelligence through a subcarrier channel, permitting reduction of recorded or transmitted multiplexed data occurring at max. intelligence frequencies with errors of less than 1% of bandwidth. Complete compensation for speed change error in tape recorded data can be provided.

Further information, including detailed characteristics of the instrument, may be obtained by writing Sales Engineering Department, Electro-Mechanical Research, Inc., Ridgefield, Conn.

CHARACTERISTICS

The basic discriminator unit is operable over the frequency ranges and deviations stated. The Channel Selector unit, including Band Pass Input Filter, Frequency Determining Network, and Output Filter establish subcarrier center frequency, deviation, and intelligence bandwidth.

Frequencies available	400 cps to 100 Kc.
Subcarrier frequency deviation	Up to ±50% of Center Frequency.
Intelligence frequency	From DC to as much as 30% of Center Frequency.
Harmonic distortion	Less than 1%.
Input impedance	0.5 megohms shunted by approx. 20 mmfd.
Input range	Dynamic range for any input level setting is 30 db. 10 mv minimum input.
Amplitude modulation and tape drop out	50% square wave amplitude modulation of subcarrier results in change in output amplitude equivalent to less than 1% of bandwidth.
Output	Single ended and referred to ground. Will drive most pen motors or other recording devices to full scale.
Output limiters	Output amplifier is designed to limit at ±20 ma.
Linearity of output vs subcarrier frequency	Within 0.1% of bandwidth.
Output stability	Zero drift does not exceed 0.5% of bandwidth in a 15-hour period.
Sensitivity stability	Within ±0.25% of bandwidth.
Max. output noise	Equivalent to less than 0.1% of bandwidth.
Power source	105-125 volts, 60 cps, 170 watts, unregulated.

Speed change error compensation analysis for system using Model 67 Discriminator

$$N_r = \frac{N}{100}\sqrt{1 + .0042\left(\frac{f_1}{f_d}\right)^2 I^2}$$

where

N_r = peak to peak residual wow or flutter component after compensation at frequency f_1 in percent of bandwidth ahead of low-pass output filter.

N = peak to peak amplitude of uncompensated wow or flutter component at frequency f_1 in percent of bandwidth.

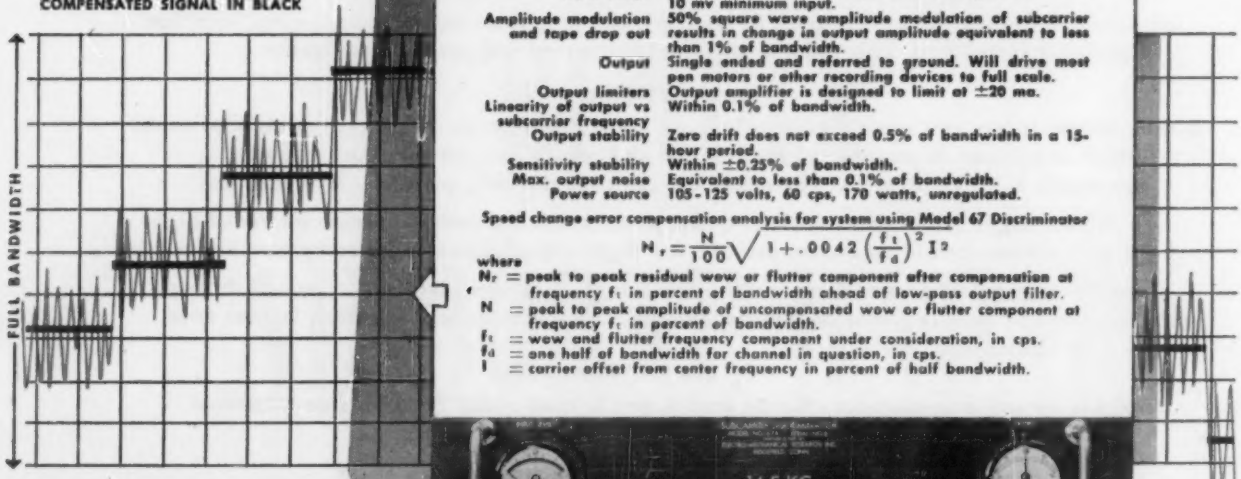
f_1 = wow and flutter frequency component under consideration, in cps.

f_d = one half of bandwidth for channel in question, in cps.

I = carrier offset from center frequency in percent of half bandwidth.

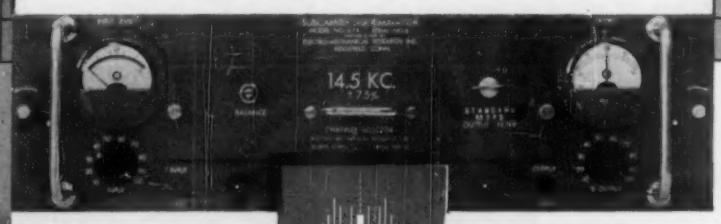
UNCOMPENSATED SIGNAL IN RED

COMPENSATED SIGNAL IN BLACK



Electronic Compensation of Magnetic Recorder Speed Change Error

3.9 Kc (±7½% Full Bandwidth) Channel



Electro-Mechanical Research, INC. e·m·r **RIDGEFIELD, CONNECTICUT**

tion shown, and this current consists of a flow of electrons from left to right. The left-hand contact is the "source" of these electrons, and the right-hand contact "drains" them out of the material. The contacts are referred to as "the source" and "the drain" and are marked accordingly in the figure. Because the n-type material has resistance, the flow of current will produce a potential drop in the material, the potential becoming more positive toward the drain. But, since the p-regions are connected to the source, the same potential will appear across the p-n junctions, and this potential is in such a direction as to bias them in reverse.

In consequence, a space-charge region will spread into the n-type material, getting wider toward the drain, as shown in Figure 4(a). The current is now constrained to flow in the center of the slab, called the "channel," and hence the resistance from source to drain is greater than with no potential applied. If the drain potential is increased, the space-charge regions will extend farther, and the source-to-drain resistance will further increase. The current versus voltage curve will, therefore, bend as shown in Figures 4(a) and (b).

If the potential is further increased, a condition will be reached at which the space-charge regions from opposite sides meet, as shown in Figure 4(c). This is called the "pinch-off" condition, with current a maximum.

It is important to consider what happens when the drain voltage is increased above the value necessary for pinch-off. This is possibly the simplest way of looking at this problem:

At first sight, it would appear that the current would increase. But should this happen, the potential drop due to the resistance of the channel would increase causing the space-charge regions to meet over a finite length of the channel and thus introduce a very high resistance between source and drain. Hence, the current cannot increase appreciably.

On the other hand, the current might decrease. However, should this happen, the potential drop in the channel would decrease causing the space-charge regions to contract. This in turn would decrease the resistance from source to drain and cause the current to increase again; so the current cannot decrease. If it cannot increase and cannot decrease it must stay constant, and this is the case illustrated by the dashed line at the right in Figure 4(c). As shown, the presence of the p-type regions causes the conducting portion of the n-type material to be narrowed down. For this reason, the p-type regions are called "the gates."

The case considered above was that

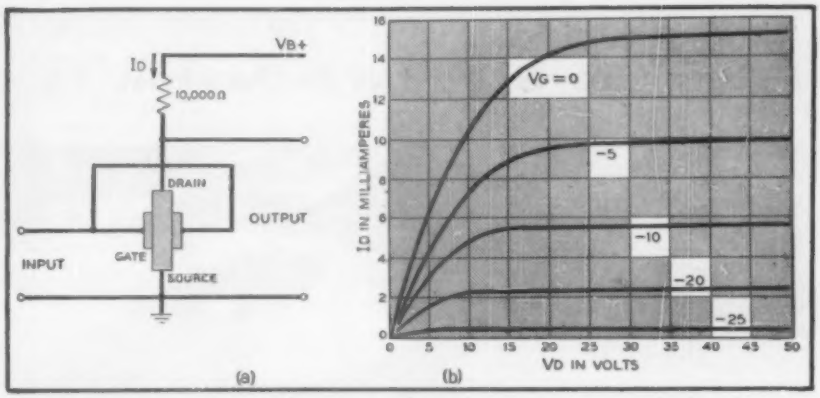


FIG. 6. An amplifier using a field-effect transistor, showing: (a) circuit diagram; (b) characteristic of a suitable transistor. This characteristic, obtained from measurements on an actual transistor, are similar to theoretical curve in Fig. 7.

in which the gates were short circuited to the source. If a potential is applied between the gates and the source in such a direction as to bias the junctions in reverse, the channel will be constricted even before drain bias is applied, as in Figure 4(d). The initial resistance from source to drain will then be higher and, when drain bias is applied, the current will always be smaller than in the case previously considered. In addition, it will now require less drain voltage to reach the pinch-off condition.

A comparison of the drain characteristic for bias and no-bias is shown in Figure 4(d), where it is seen that, with gate bias, the current is always smaller, and pinch-off occurs at a lower value of drain voltage. A theoretical drain-characteristic with gate voltage as the parameter is shown in Figure 5. As the gate voltage becomes more negative, pinch-off occurs at a lower voltage, and the pinched-off current is correspondingly decreased.

Power Amplification

Thus far only the drain-to-source current and the means of controlling it by the gate current have been considered.

If it is to be possible to obtain power amplification, this control must require very little power, and therefore, the gate-to-source impedance must be high. This gate-to-source impedance is essentially that of a p-n junction biased in reverse and in practice it can be of the order of 10 megohms. Hence, it should be possible to obtain power amplification with this device.

A circuit for this purpose, shown in Figure 6(a), contains a field-effect transistor having a reasonable characteristic for a practical design. If the value of V_a is adjusted so that the device is always operating in the pinched-off condition, a change of V_a from 0 to -5 volts produces a change in drain current of 5 ma.; that is, 1 ma. for 1 volt Thus, if V_a were changed by one volt, by applying an a.c. signal for example the drain current, I_p, would change by 1 ma., and the change in the potential drop across the 10,000-ohm load resistance would be 10 v. There would, therefore, be a ten-fold gain in the voltage.

If the gate-to-source impedance were taken to be one megohm (a very low value for a p-n junction biased in reverse), the change in input power would be $V^2/R_a = 10^{-6}$ watt, while the change in output power would be $I^2R_L = (10^{-3})^2 \times 10^4 = 10^{-2}$ watt.

Hence, there would be power gain of at least 10,000 or 40 db. A device with such characteristics would make a useful amplifier.

Field-effect transistors of the form shown in Figure 4 have been made at Bell Telephone Laboratories, and in every respect their performance has been found to be in good agreement with theory. For example, the characteristic shown in Figure 6(b) was taken from an operating unit, and it can be seen that its shape is very similar to the theoretical characteristic of Figure 5. A transconductance value—that is, change in drain current for unit change in gate voltage—of several milliamperes per volt has been achieved together with successful operation at frequencies

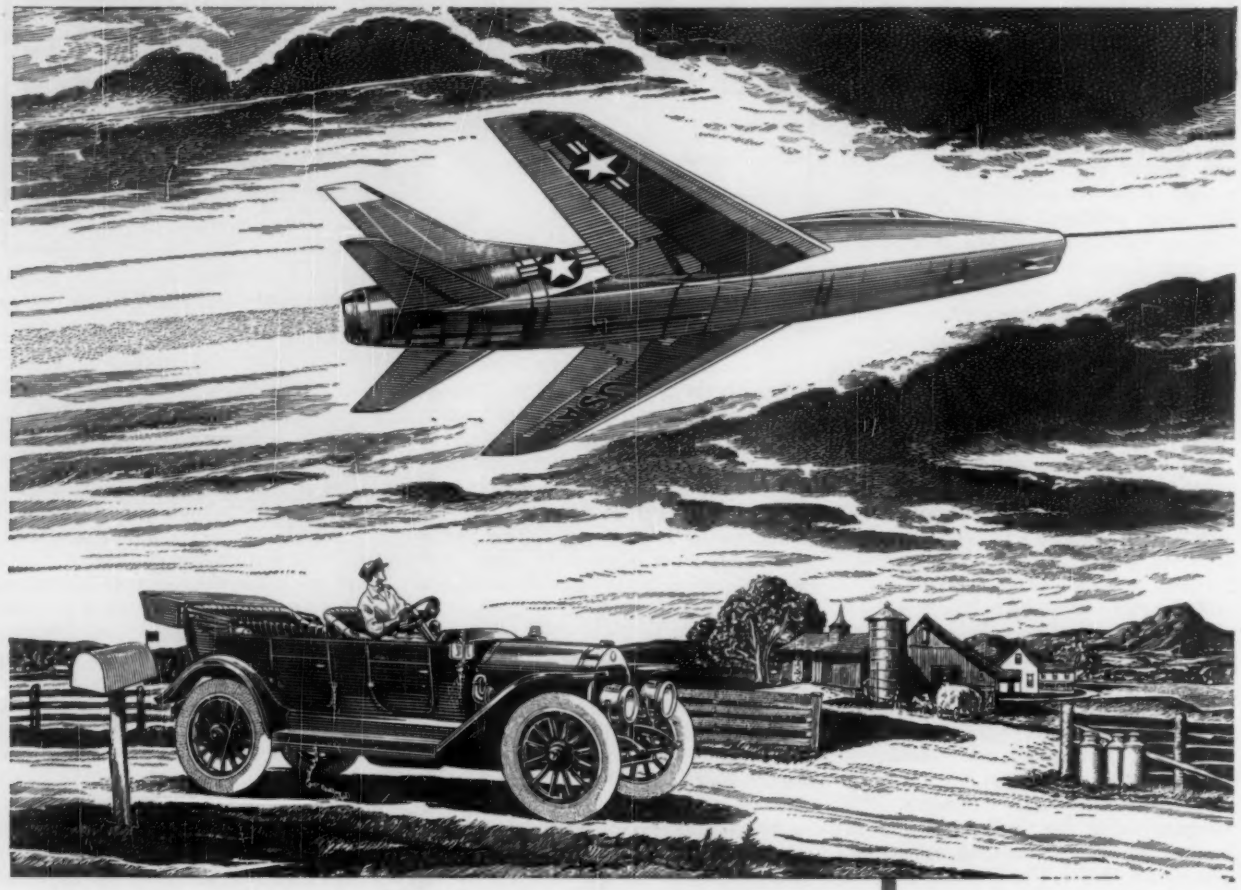
10-Lb. Transponder

Lightplane traffic control transponder, a low-cost, small, lightweight version weighing only 10 lb., has been developed by Radio Receptor Co.

Although the prototype does not meet all common system requirements in its present form, a company spokesman says the unit can be easily designed to do so.

In quantities of a thousand or more, the company estimates the transponder could sell for $300-400.

From the Stoddard-Dayton to the Super Sabre



Speco's creative engineers have opened new horizons in precision!

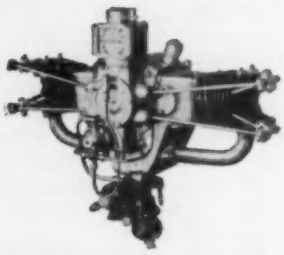
If you recall the Stoddard-Dayton, then surely you remember the Jenny – the sweetheart of World War I. They were a couple of kids who "grew up together" . . . the car and the airplane. And today their grandchildren are the mainstays of our national economy.

We like to feel that our leadership in precision on a mass production basis has played a big role in this growth. Our work in all industries—automotive, aviation, industrial . . . in fact, in all fields of mechanics and hydraulics – has made great contributions. Our team of precision engineers, toolmakers and machinists makes certain that *If We Ship It . . . It's Right!* If you have a job with which you feel we might help, a short letter or a telephone call will bring prompt, sound guidance. Or if you'd like the whole SPECO story—from plant to people to products, send for our new Plant Brochure. The Steel Products Engineering Company, Springfield, Ohio.

THE STEEL PRODUCTS ENGINEERING COMPANY

SPECO

BEAUTIFUL 11" X 14" REPRODUCTIONS OF THIS PICTURE SUITABLE FOR FRAMING WILL BE SENT ON REQUEST—FREE.



One of our early contributions to aviation—this two cylinder, Opposed Piston Blower Engine produced by Speco in 1924.

Today we're building precision mounts for nearly every major manufacturer of radar equipment—and many other component parts.

as high as 50 megacycles per second.

So far the work is still in an early stage and it is expected that much better performance will ultimately be achieved. Nevertheless, the initial results have been very promising. On an experimental basis, field-effect transistors have been used in amplifiers and oscillators as well as in frequency and amplitude modulation circuits.

How does the field-effect transistor compare with other electronic amplifying devices?

As compared with electron tubes, the drain characteristic is very similar to the plate characteristic of a pentode tube.

The high impedance input characteristic is also similar to that of the pentode tube, and the values of transconductance and frequency response are comparable.

Thus, it appears that the field-effect transistor could perform many of the functions for which the pentode tube is now used. In addition, it has all the usual advantages of a transistor over an electron tube, being small, rugged, and light weight, requiring no heater power, and possibly having much longer life.

How does it compare with a junction transistor?

There are a number of differences of practical importance. First, in the field-effect type, the current carriers are traveling in an electric field whereas in the junction transistor they are moving by diffusion. Since the velocity in a field is much higher than the velocity of diffusion, the transit time for transistors of the same size will be much shorter in the field-effect type. Since the maximum frequency of operation of both devices is limited by the transit time, the field-effect transistor is intrinsically capable of operating at higher frequencies (See Filter Center item, "New HF Transistors," p. 58.)

Second, the field-effect transistor has a high input impedance, whereas the junction transistor has low input impedance. This difference affects the associated circuitry and may make one or the other transistor more suitable in a particular application. The field-effect transistor, even with ultimate design conditions, would probably not be capable of operating with such high efficiency at such low power levels as the junction transistor.

It is too early in the development of the field-effect transistor to make definite statements as to its possible future uses.

It would appear that it would find its main applications where considerations of size, weight, and power consumption dictate the use of a transistor, and where the required frequency response is higher than could be achieved with a simple junction transistor.

Avionics Bulletins

Recently announced bulletins and catalogs of interest to persons in the avionics field include:

• **Procedure for Transducer Evaluation** is the title of a 4-page bulletin (No. KCE-491) available from Crescent Engineering & Research Co., 11632 McBean St., El Monte, Calif.

• **Digital data repeaters,** to provide remote counter-type indication from synchro or other analog-type voltages. Description and application engineering data is included in 6-page folder (A-2372). A.C. Spark Plug Div., General Motors Corp., 1925 East Kenilworth Place, Milwaukee 2, Wis.

• **Resistors and resistance devices** of a variety of types are described in Catalog No. 55. Clarostat Manuf. Co., Inc., Dover, N. H.

• **Precision AN pots,** offering linearity within 0.025%, are described in data sheet 54-11. Write to Technical Information Service, Helipot Corp., South Pasadena, Calif.

• **Precision lab instruments,** including impedance bridges, associated amplifiers, decade-type voltage dividers and resistance boxes, are described in 8-page catalog. Electro-Measurements, Inc., 4312 S.E. Stark St., Portland 15, Ore.

• **Subminiature toroids,** in six package styles and three core types, are described in 4-page bulletin. Communications Accessories Co., Red Bridge Rd., Hickman Hills, Mo.

• **Hermetic seals** (compression plugs) for providing metal to glass bond. Variety of shapes in both glass and metal construction are described in 12-page catalog No. 300-PS series. Hermetic Seal Products Co., 29-37 South Sixth St., Newark 7, N. J.

• **Silicon junction diodes,** including specs and product information (8 pp.). Hughes Aircraft Co., Semiconductor Div., Culver City, Calif.

• **"What We Make"** is the title of an 8-page

FOR ENGINEERS there's a challenging job ahead in designing for both the military and commercial markets.

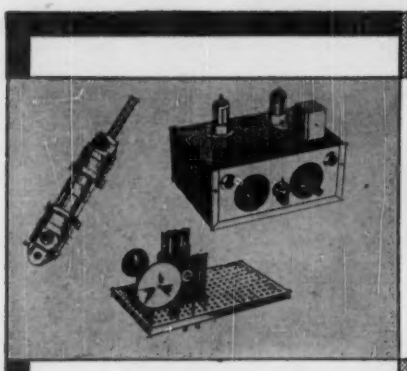
we have openings for ..

Aerodynamics Engineers • Instrumentation Engineers • Test Engineers (Flight & Structures) • Stress Engineers • Design Engineers • Electrical • Power Plant Installation • Equipment • Transmission • Vibration Engineers • Airframes •

Positions available at all levels of responsibility.
Salaries commensurate with training and experience.

Send resume of your employment background to Frank Coe, Employment Manager

Piasecki helicopter corporation
MORTON, PENNSYLVANIA



problems in...
HYDRAULICS
ELECTRONICS
MECHANICAL
DEVICES?

PARAMETERS

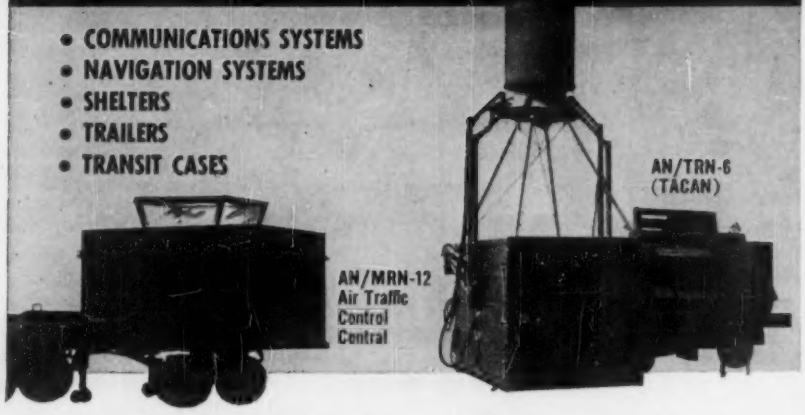
. . . . . offers the facilities of its uniquely qualified staff and well equipped plant to service your needs.

THEORETICAL ANALYSIS PRODUCT DEVELOPMENT
TEST ANALYSIS LIMITED MANUFACTURE

Please direct your inquiry to:
Liaison Engineer
PARAMETERS, INC.
195 Herricks Road • Garden City Park, L. I., New York
Pioneer 6-0155

Craig ELECTRONIC SYSTEMS
design • manufacture • installation • servicing

- COMMUNICATIONS SYSTEMS
- NAVIGATION SYSTEMS
- SHELTERS
- TRAILERS
- TRANSIT CASES



other typical Craig installations
- Direction Finder Set AN/TRD-9
- Radio Direction Finder AN/CRD-6
- Air Traffic Control Central AN/MRN-14 (XW-1)
- Radio Receiving Set AN/TRR-7
- Radio Transmitting Set AN/TRT-3
- Radio Set AN/TRC-32
- Radar Set AN/FPN-16

Craig INC.
Danvers, Mass.
TEL. — DANVERS 1870

brochure describing a variety of motors and motor-driven blowers for aircraft and missile use. Rotron Manuf. Co., Inc., Woodstock, N. Y.

• **Computer Development at the National Bureau of Standards,** covering the SEAC and DYSEAC computers, is reported in NBS Circular 551 (146 pp.). Price: $2.00. Order from Government Printing Office, Washington 25, D. C.

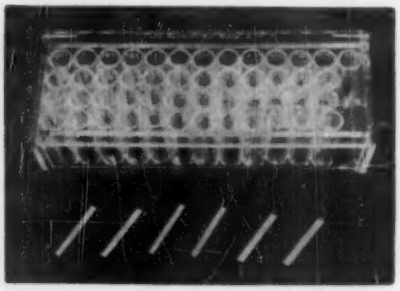
• **Molded deposited carbon resistors,** ½ watt, application engineering data. Bulletin B-9. International Resistance Co., 401 No. Broad St., Philadelphia 8, Pa.

• **Precision potentiometers,** both linear and non-linear types. Bulletin V321 gives specs and application data (4 pp.). Vari-Ohm Corp., Sunrise Highway at Albany Ave., Amityville, N. Y.

FILTER CENTER

▶ **Shoebox-Size Digital Computer**—An airborne "central station" digital computer, capable of providing bombing, fire control, navigation and other services, can be built in a unit no larger than a shoebox, Librascope engineers believe, as a result of significant new computer techniques and components which the firm has developed. One of these is a complete flip-flop circuit which will fit into a thimble.

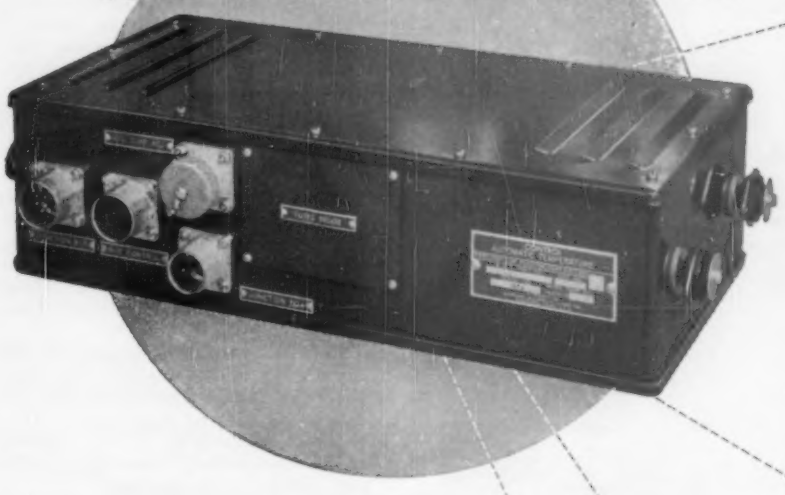
▶ **Do-It-Yourself Resistor Kit**—New kit for lab and development use contains tape resistors—10 each of 49 different MIL-R-11A values (ranging from 100



ohms to 1 megohm), to 10% tolerance. Kit RNP-1C sells for $49.50. Manufacturer: Hansen Electronics, 7117 Santa Monica Blvd., Los Angeles 46, Calif.

▶ **New HF Transistors**—New "meltback" process developed by General Electric for making semiconductor crystals enables transistors to operate at frequencies "five times higher than ordinary transistors . . . (with) greatly improved power amplification characteristics," GE says. Meltback process cuts ingot cooling time from 20 minutes (in previous rate-grown process) to something less than a second. The process gives improved control of impurities in the thin layers of germanium or silicon crystals. The number of impurities which migrate from proper layer into adjoining layer is reduced to about one-thirtieth the previous figure, GE says.

Complete RELIABILITY...



first essential in aircraft electronics

Engine-control electronic equipment is frequently installed in close proximity to the turbojet engine. Therefore, electronic components must be designed and constructed to function with *complete reliability* under extreme ambient conditions. However, the degree of reliability attained depends largely upon the attention given to detail in applying these five major design principles to every phase of equipment development:

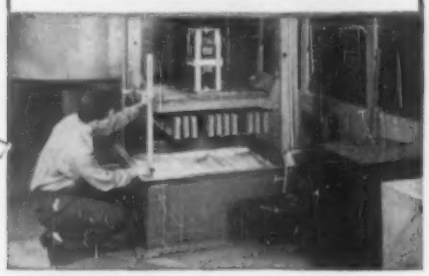
1. Conception of basically simple circuitry to accomplish desired control functions.
2. Rugged design of mechanical details.
3. Selection of components based upon extensive environmental and life tests.
4. Operation of all components well below their maximum rating.
5. Adequate performance tests of production units under dynamic operating conditions.

Strict adherence to these principles has enabled us to achieve extreme reliability in all our aircraft electronic equipment. We believe our years of concentrated research, development and tests devoted exclusively to automatic control systems for jet engines can be of real value in solving your control problems. Our engineering counsel and extensive manufacturing and test facilities are at your service. We welcome your inquiry.

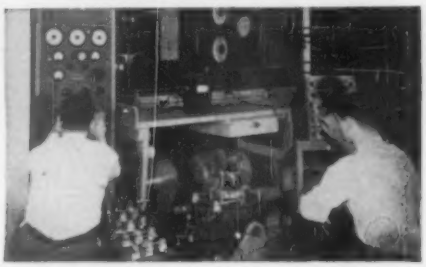
TEMPERATURE CONTROL AMPLIFIER (*Illustrated above*). Modulates exhaust nozzle area of a turbojet engine to maintain a constant turbine exit temperature. Input signal is derived from thermocouples. Output controls a servo which supplies hydraulic power to the exhaust nozzle positioning actuators.

TEST SPECIFICATIONS. **MIL-E-5009A:** Altitude, ignition proof, sand and dust, humidity, sustained acceleration, impact. **MIL-E-5272A:** Salt Spray. **MIL-E-5007A:** General specification. **MIL-I-6181:** Radio Interference.

SIMULATED OPERATING CONDITIONS PROVE COMPONENT PERFORMANCE

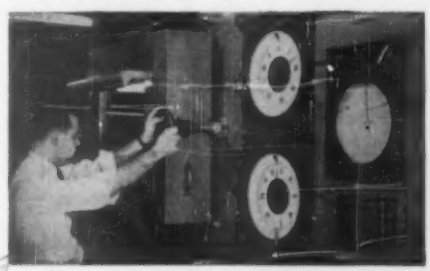


IMPACT. Unit must withstand impact shocks of 30g for a time duration of not less than 10 milliseconds.

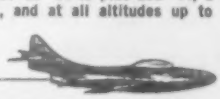


VIBRATION. Operational accuracy guaranteed at 5g from 20 to 55cps and at 10g from 55 to 225cps.

SUSTAINED ACCELERATION. Unit must operate satisfactorily while subjected to sustained acceleration of 8g along its longitudinal axis, 10g along its vertical axis, and 5g along its horizontal axis.



FLIGHT TEST CHAMBER. Unit performance checked under simulated flight conditions within a temperature range of minus 65° F. to plus 200° F., a relative humidity of 95%, and at all altitudes up to 50,000 feet.



MANNING, MAXWELL & MOORE, INC.

AIRCRAFT PRODUCTS DIVISION • DANBURY, CONN. • STRATFORD, CONN. • INGLEWOOD, CALIF.

OUR AIRCRAFT PRODUCTS INCLUDE: TURBOJET ENGINE TEMPERATURE CONTROL AMPLIFIERS • ELECTRONIC AMPLIFIERS PRESSURE SWITCHES FOR ROCKETS, JET ENGINE AND AIRFRAME APPLICATIONS • PRESSURE GAUGES THERMOCOUPLES • HYDRAULIC VALVES • JET ENGINE AFTERBURNER CONTROL SYSTEMS.

Wickes

PORTABLE CONTROL TOWERS

Transportable by helicopter or truck. Available in a variety of models — or we will design to suit requirements. Include radio telephone transmitting and receiving equipment, aerological instruments, and field lighting control facilities.

Inset shows portable tower being raised to top of structure, using hoisting equipment supplied. Sectionalized towers available in any height.

Consult us for your control tower requirements.

Wickes ENGINEERING AND CONSTRUCTION COMPANY

ESTABLISHED 1920

13TH STREET AND FERRY AVENUE — CAMDEN 4, NEW JERSEY

Have you heard about Permadizing?*

*Stillman's exclusive Permadizing Process for rubber-to-metal bonding allows designers to specify steel-smooth rubber-to-metal bonded parts under a wider range of temperature and pressure than ever before. It's a high-production process, too, giving consistent, variation-free results even over the longest runs.

Send for illustrated catalog SR-2

Stillman Rubber Co.

23525 Lorain Rd., Cleveland 26, Ohio - 5811 Marilyn Ave., Culver City, Calif.

AVIATION CALENDAR

July 2—Air Force Assn., second annual Earl T. Ricks Memorial Trophy competition for Air National Guard jet pilots, Los Angeles to Detroit.

July 2-3—Second annual Western New York Air Show and Races, Dansville Airport, Dansville, N. Y.

July 2-4—International Aviation Exposition, Detroit-Wayne Major Airport, Detroit.

July 2-6—Ninth annual All-Woman Transcontinental Air Race, Long Beach, Calif., to Springfield, Mass.

July 2-14—Twenty-second National Soaring Contest, Harris Hill, Elmira, N. Y.

July 5-7—Office of Naval Research and Ryan Aeronautical Co., international symposium on radar, radio and sound wave propagation through stratified media, Navy Electronics Laboratory, San Diego.

July 11-22—Special summer program on Aerodynamics of Unsteady Flow, Massachusetts Institute of Technology, Cambridge.

July 12-14—Western Plant Maintenance and Engineering Show, produced by Clapp and Poliak, Pan Pacific Auditorium, Los Angeles.

July 16-24—Philadelphia Glider Council, annual open house, Philadelphia Gliderport, Hilltown, Pa.

July 27-29—Rotterdam Helicopter Congress, Rotterdam, The Netherlands.

Aug. 5-7—Experimental Aircraft Assn., third annual Fly-In and Convention, Curtiss-Wright Airport, Milwaukee.

Aug. 8-10—Institute of the Aeronautical Sciences, second National Turbine Powered Air Transportation Meeting, Olympic Hotel, Seattle.

Aug. 11-14—Air Force Assn., Convention and Airpower Panorama, San Francisco.

Aug. 15-17—Society of Automotive Engineers, West Coast Golden Anniversary Meeting, Hotel Multnomah, Portland, Ore.

Aug. 22-23—Symposium on Electronics in Automatic Production, sponsored by Stanford Research Institute and the National Industrial Conference Board, Sheraton-Palace Hotel, San Francisco.

Aug. 24-25—Western Electronic Show and Convention (WESCON), Civic Auditorium and Fairmont Hotel, San Francisco.

Aug. 24-26—International Ignition Conference, conducted by Scintilla Division of Bendix Aviation Corp., Sidney, N. Y.

Sept. 3-5—Twenty-ninth National Aircraft Show, Philadelphia International Airport.

Sept. 3-9—Aircraft Owners & Pilots Assn., eighth annual Roundup Flight Cruise, New York to Bermuda.

Sept. 12-16—Instrument Society of America, 10th annual Conference and Exhibit, Shrine Exposition Hall and Auditorium, Los Angeles.

Sept. 17—Institute of Radio Engineers, Symposium on Automation, Cedar Rapids, Iowa.

Sept. 28-29—American Iistitute of Electrical Engineers and Institute of Radio Engineers, 1955, Industrial Electronics Conference, Park Sheraton Hotel, Detroit.

Oct. 3-5—Eleventh annual National Electronics Conference, Hotel Sherman, Chicago.

One step closer

TED BOTTEMA

GLEN HEADMAN

Meet Ted Bottema and Glen Headman,

Westinghouse AGT field service engineers, headquartering in Dallas, Texas, and Edwards Air Force Base, respectively. These men and their teammates in your area offer you the benefits of years of aviation experience and are backed by a headquarters staff of engine service specialists. They can help you with many service problems. For example, they can give you complete information on the product described on the next two pages:

New silicones that run clean at extreme speeds and temperatures

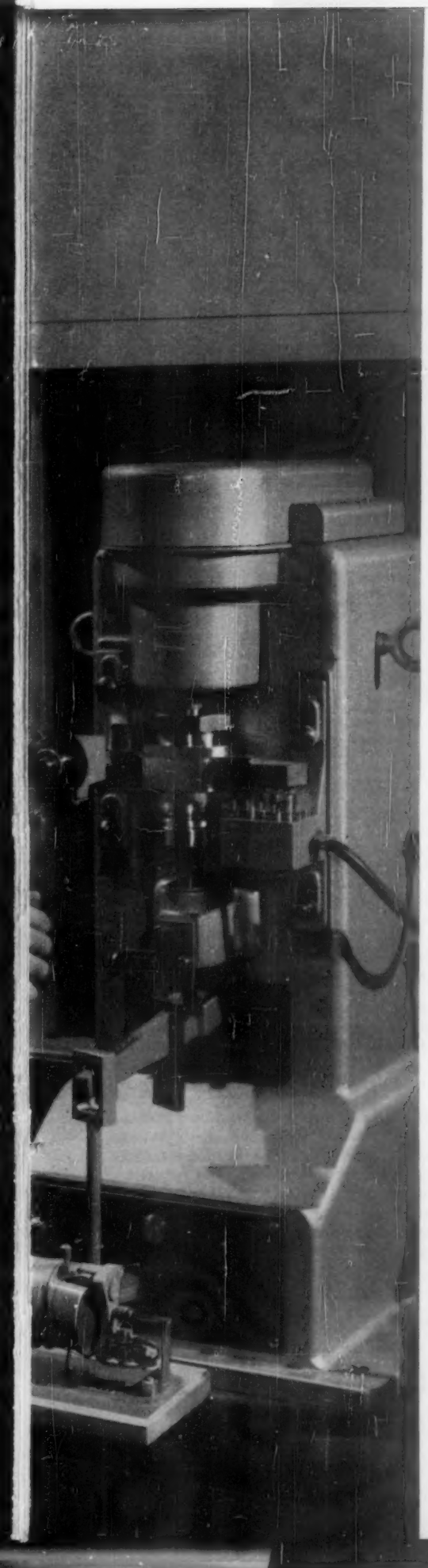
Shown here is Dr. G. C. Gainer, the Westinghouse scientist who developed the lubricant. The sample of the new silicone he is pouring was heated to 480°F for over 100 hours, yet it remains clear. The conventional lubricant at the left shows a large degree of sludge formation after only four hours at 480°F. J-91031-A

FOR MORE INFORMATION ON WHAT THIS NEW LUBRICANT WILL DO FOR YOU . . . TURN THE PAGE

YOU CAN BE SURE...IF IT'S Westinghouse

TOMORROW'S AIRCRAFT: *One step closer*

New silicones run clean at extreme speeds and temperatures



Out of the Westinghouse Materials Engineering Laboratories and the Aviation Gas Turbine Division has come a new silicone lubricant so good it actually isn't needed for anything but the fastest and most powerful jet engines. This new oil eliminates sludge. It stays clean on bearings and gears at tremendous pressures and temperatures.

Present oils are adequate for many of today's jet applications. But engineers look to the new lubricant to solve problems that will exist at the extreme speeds and high ram air temperatures already forecast for the future. The new oil holds great promise for application in jet-powered missiles for military use.

The silicone lubricant was perfected by changing the structure of the silicone molecule. The new oil forms a close-packed layer of protective lubrication. After passing every laboratory torture test with flying colors, the oil was tested in jet engines. There was a complete absence of sludge at the completion of the test.

This new development is typical of the kind of diversified, company-wide attention your problems get when you give them to AGT. This ability to put the right man to work on the job and to give him the right facilities is one more Westinghouse means of helping you bring tomorrow's aircraft . . . One Step Closer. J-91031-B

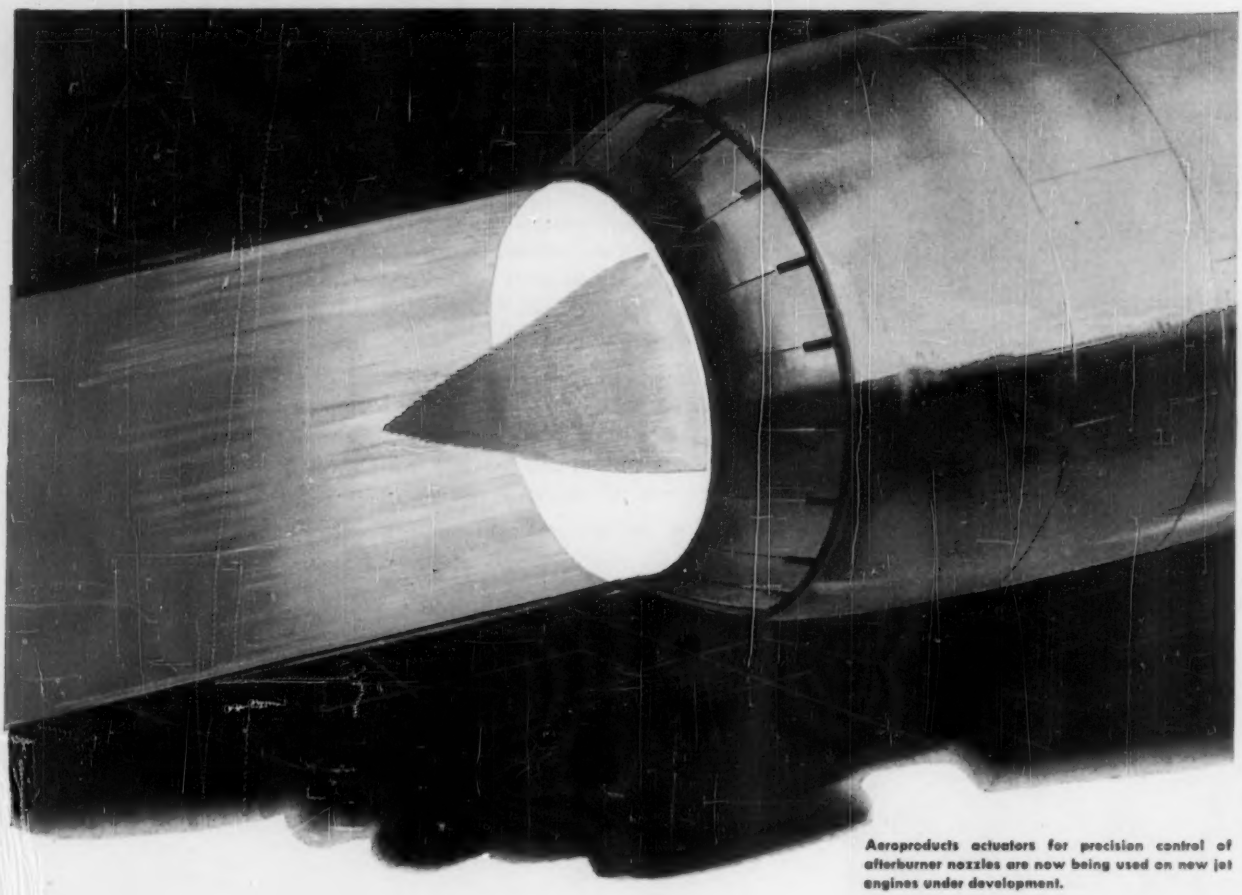
Dr. Gordon C. Gainer, Westinghouse materials engineer, and AGT's George Townsend co-operated in developing the new silicone. Adapting it to jet engine use is an example of corporate co-operative effort available to you through your local Westinghouse AGT sales engineer.

THE WESTINGHOUSE AVIATION FAMILY

Jet Propulsion • Airborne Systems Components • Wind Tunnels
Airborne Electronics • Airport Lighting • Ground Electronics
Aircraft Electrical Systems and Motors

YOU CAN BE SURE...IF IT'S

Westinghouse



Aeroproducts actuators for precision control of afterburner nozzles are now being used on new jet engines under development.

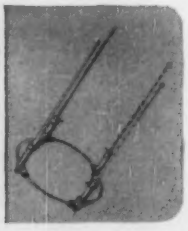
Positive Control Instantly!

AEROPRODUCTS SYNCHRONIZED ACTUATORS PROVIDE POSITIVE SYNCHRONIZATION OF MULTIPLE HYDRAULIC CYLINDERS

AIR-DRIVEN GENERATOR

TURBOPROP

AIR-DRIVEN HYDRAULIC PUMP



ACTUATORS FOR AFTERBURNERS

Now, Aeroproducts mechanically synchronized hydraulic actuators assure precise positioning among the multiple attaching points of the afterburner nozzle.

Other models of Aeroproducts actuators combine synchronized travel with additional desirable features such as positive-acting, infinitely positioning brakes, and auxiliary power drives.

These actuators, in both hydraulic and pneumatic versions, are applicable to all high-ambient temperature installations, including jet engine thrust reversers, flaps, and split-control surfaces on guided missiles.

If you're on a team designing a new airplane or powerplant, you'll find Aeroproducts ready to meet your most detailed specifications—for turbo-propellers, other propellers requiring high horsepower absorption, actuators, air-driven generators and hydraulic pumps, and other aircraft components now in the development stage.

General Motors engineering leads the way

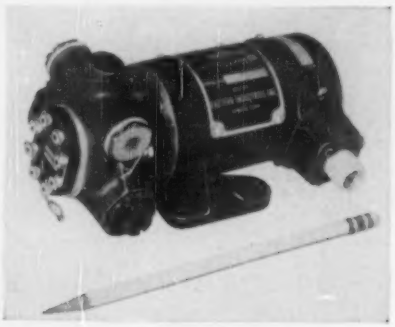
GM GENERAL MOTORS

Building for today...Designing for tomorrow

Aeroproducts

ALLISON DIVISION OF GENERAL MOTORS • DAYTON, OHIO

NEW AVIATION PRODUCTS



New Plane and Missile Pumps

Series 1700 aircraft-type pumps for planes and missiles operate efficiently with motors up to 10,000 rpm., the maker reports, and require no gear train or gear-head motor.

Smallest pump in the series has a 0.00419-cu. in. displacement per revolution and the largest has 0.02514-cu. in. displacement. Smallest unit weighs 1 lb. 12 oz. with motor and measures 5¼ x 2¼ x 2¼in. It pumps 55 gph. at 65 psi. of MIL-0-5606 liquid.

Eastern Industries, 100 Skiff St., Hamden 14, Conn.

New Amplifiers for Aircraft

Two new amplifiers for aircraft cockpit and cabin use have been developed for audio and isolation applications:

• **AA-208 audio amplifier** has provisions for two inputs isolated a minimum of 30 db. A third input suitable for call systems is also provided. Unit will provide 8 w. audio output with 2% harmonic distortion. Frequency response is said to be flat from 300 to 6,000 cycles.

Equipment is wired for 115-v. 400-cycle and 28-v. d.c. voltage input operation. Internal jumpers allow use of 14 v. d.c. and/or a separate dynamotor for high-voltage supply. AA-208 weighs 3 lb. 7 oz., including shockmounts, and is contained in a welded aluminum box 6½x3¾x4 in. List price is $185.

• **AI-125 isolation amplifier** is a dual-

McGraw-Hill Mailing Lists Will Help You

• Merchandise your advertising • Conduct Surveys
• Get leads for your salesmen
• Get inquiries about your product or service
• Pin-point geographical or functional groups
• Sell Direct • Build up weak territories • Aid Dealer Relations

Direct Mail is a necessary supplement to a well rounded Business Paper Advertising program.

600,000 actual names of the top buying influences in all the fields covered by the McGraw-Hill publications make up our 150 mailing lists. These are built and maintained primarily for our own use, but they are available to you for Direct Mail purposes. Pick out a list of YOUR prospect from our Industrial Direct Mail Catalogue.

More and more, progressive companies are using Industrial Direct Mail regularly as an advertising medium. They effectively allocate a portion of their concentrate on the best business publication.

For complete, detailed information about our service, fill in the coupon or write for your copy of our free Business and Industrial Direct Mail catalogue.

Direct Mail Division, McGraw-Hill Publishing Co., Inc.
330 West 42nd St., N. Y. 36, N. Y.

Please forward my free copy of the McGraw-Hill "Industrial Direct Mail Catalogue."

Name_____

Company_____

Address_____

City_____ State_____

COMPONENT—PRODUCT
Qualification & Research

TESTING

for Industry and Government Agencies

One of the Nation's Largest and Best Equipped Commercial Testing Laboratories Specializing in Complete Qualification and Acceptance Testing to MIL Specs.

*

TEST EQUIPMENT

ENGINEERED AND CUSTOM BUILT

*

INLAND TESTING LABORATORIES

1457 Diversey Parkway, Chicago 14, Ill.
DIversey 8-6700

AERODYNAMICISTS

★ New subsonic and supersonic projects are creating an urgent demand for aerodynamicists at Northrop Aircraft, Inc., America's first company in the vital development, design and production of all-weather and pilotless aircraft.

★ If your training and experience qualifies you for one of these challenging assignments, please telephone or wire collect:

Mr. Robert Ehinger
Manager of Engineering
Industrial Relations
Northrop Aircraft, Inc
Hawthorne, California

★ Expense-free Los Angeles interviews will be arranged for qualified applicants.

NORTHROP AIRCRAFT
INCORPORATED
HAWTHORNE, CALIFORNIA

PRESSURIZE ELECTRONIC EQUIPMENT

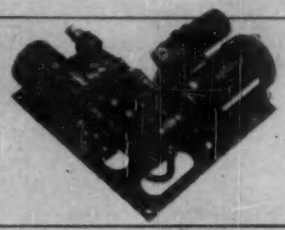
with Eastern UNITS

The extensive line of Eastern Pressurization Units for airborne electronic equipment accommodates a broad range of requirements, and meets appropriate government standards.

Units can be modified to meet your specific requirements. These modifications usually consist of: 1) Different compressors; 2) Motor change to meet your requirement; 3) Change in pressure switch settings; 4) Different mounting provisions. Eastern welcomes the opportunity to discuss and quote on your particular application problem.

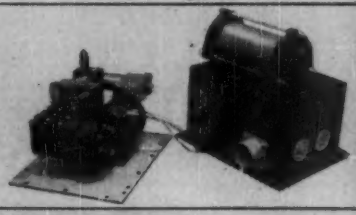
MODEL E AP-100 TYPE 202

- Maintains a system pressure of 25 P.S.I.A. minimum.
- Motor is .03 H.P.—10,000 R.P.M., 208 V., 3 ph., 400 cy.
- Current draw is .7 amperes/phase maximum under normal operating conditions
- Unit operates continuously
- Weight is 4¾ lbs. maximum



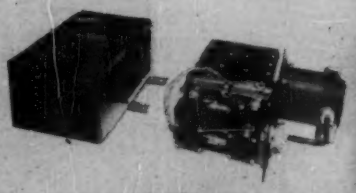
MODEL E AP-150 TYPE 205

- Operating pressure switch maintains a system pressure of 17 P.S.I.A.
- Motor is 1/25 H.P. 7,500 R.P.M., 27 volts D.C. — T.E.B.B.
- Current draw is 2.0 amperes maximum under normal operating conditions
- Life is 500 operating hours
- Weight is 8 lbs. maximum



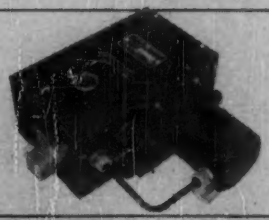
MODEL E AP-1500 TYPE 203

- Operating pressure switch maintains a system pressure of 30 P.S.I.A.
- Motor is 1/15 H.P. nominal 24-28 volts D.C., 5,000 R.P.M., continuous duty, shunt wound
- Current draw is 3.4 amperes maximum under normal operating conditions
- Life is 500 operating hours
- Weight is 12 lbs. maximum



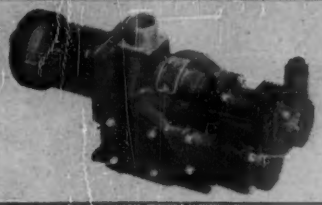
MODEL E AP-2400 TYPE 201B

- Maintains system pressure of 31 P.S.I.A.
- Motor is 1/10 H.P., 24-28 volts D.C., 5,000 R.P.M. continuous duty
- Current draw is 5.5 amperes maximum
- Life is 500 operating hours
- Weight is 10-3/4 lbs. maximum



MODEL E AP-3600 TYPE 200

- Maintains system pressure of 31 P.S.I.A.
- Motor is 1/7 H.P., 10,000 R.P.M.
- Current draw is { 208 V., 400 cy., 3 ph. / 24-28 V.D.C. } continuous operation { 1.3 amp./phase / 7.1 on D.C. } amperes maximum under normal operating conditions
- Life is 1,000 operating hours
- Weight is 8-1/2 lb. maximum



Eastern INDUSTRIES, INC.
100 SKIFF STREET
HAMDEN 14, CONN.

COMPLETE AVIATION CATALOG #330-P ON REQUEST.

channel unit for use where receiver selector switches are to be mounted overhead in the cockpit or on pedestal control panels.

It has provisions for eight individual outputs and crew interphone service. Any combination of receiver and interphone can be handled by pilot or co-pilot without affecting headset volume of the other. Interlock circuit allows by-passing the isolation amplifier in event of failure.

AI-125 is contained in a folded aluminum case 6x3¾x6 in. Weight is 3 lb. 2 oz. List price is $275.

Aviation Accessories, P.O. Box 4178, 3603 North Main, Fort Worth 6, Tex.

Jeep Carryall Hauls 2,000 Lb.

New Jeep carryall, capable of hauling 2,000 lb of airmail, express, freight and usable as a tow vehicle, has removable sides to permit easy fork-lift loading. The unit was developed from a standard Kaiser-Willys truck chassis. Wheel base is extended from 80 in. to 95 in.

United Air Lines participated in the design and has placed 10 of the vehicles in service at seven cities.

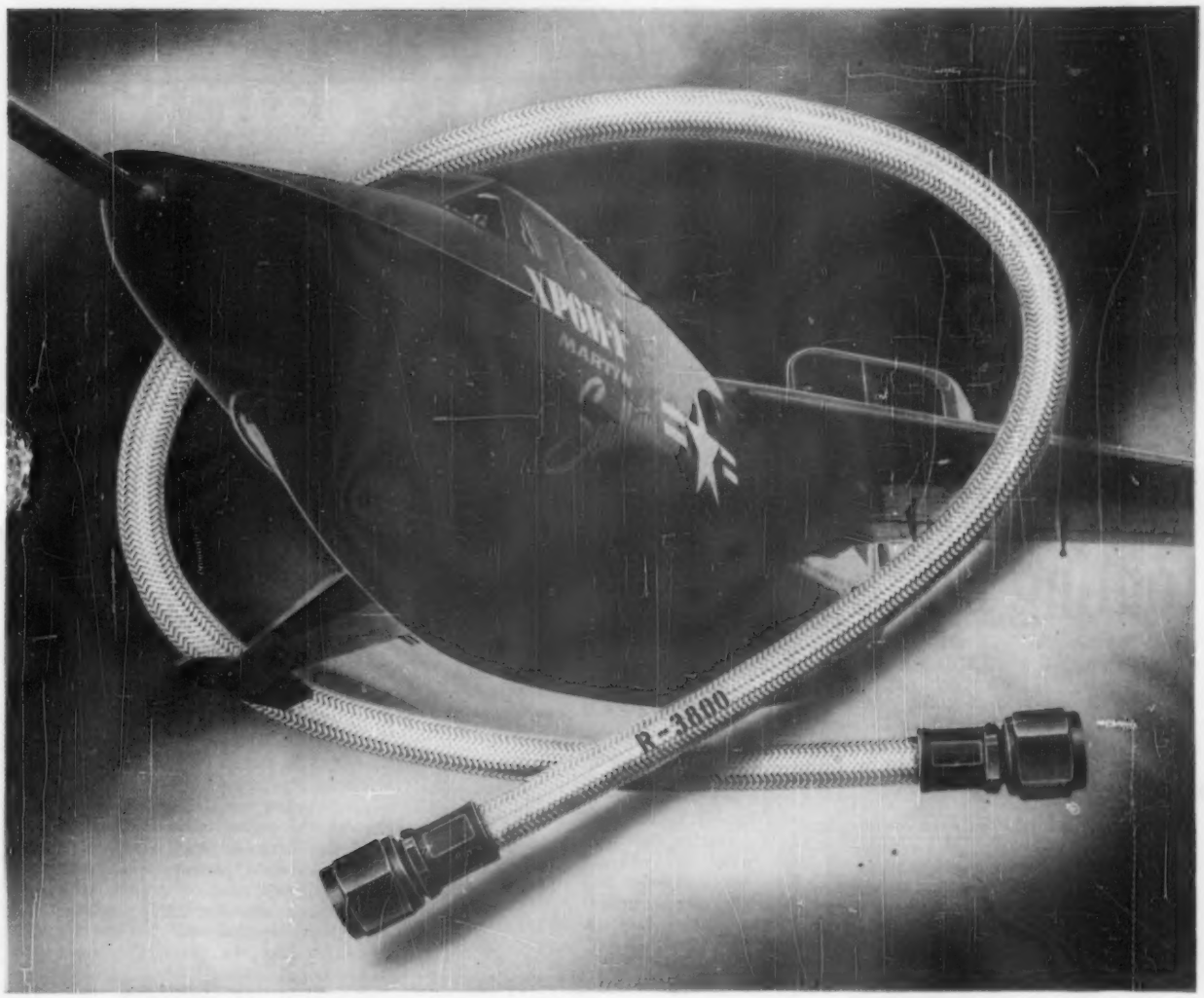
R. W. Allen & Co., San Carlos, Calif.

Transistors in Amplifier

Transistorized booster amplifier, designed to meet military and civil plane requirements, operates directly from the 28-v. d.c. system, requiring no dynamotor. This means that the only weight added is the 14-oz. amplifier unit, the maker says.

Model 5502 provides output of 10 w. from a 1-w. source. Input and output impedance are both 15 ohms. Frequency response is flat within 1 db. from 300 to 6,000 cycles, it is reported. Etched circuit boards are said to provide long life. Unit measure 5⅛x2⅜x 1¾ in.

Lear, Inc., LearCal Division, 3171 S. Bundy Dr., Santa Monica, Calif.



Weight-saving 450°F FLUOROFLEX-T "plumbing" in the MARTIN SeaMaster and its 4 engines

The world's first multi-jet attack seaplane uses the world's first Teflon-compound hose.

Fluoroflex®-T R3800 hose assemblies are used to convey fuel and oil, and as vent lines in the sleek SeaMaster . . . and are on its four powerful turbojet engines too. All in all, they add up to a sizable saving in weight over other hose types.

Fluoroflex-T lightweight, corrosion-resistant lines are made with Teflon® compounded tube, 304 stainless steel braid, and blowout-proof fittings. Their flexibility stays the same from −100°F to +450°F . . . indefinitely.

R-3800 assemblies are Service approved for synthetic fuels, oils. You'll be hearing about them in more and more engines, airframes and missiles, where they solve high temperature operating problems. For more data, ask for Bulletin FH-2.

®Fluoroflex is a Resistoflex registered trade mark for products from fluorocarbon resins. Teflon is the DuPont registered trade mark for its tetrafluoroethylene resin.

RESISTOFLEX
CORPORATION

Belleville 9, N. J. • Western Division: Burbank, Calif.

Our 18th year of service to key industries

P.S. *Fluoroflex-T spiral back-up rings—another Resistoflex product from fluorocarbon resins—are also in the SeaMaster, contributing to the reliable performance of hydraulic control circuits.*

Leading Aircraft

Manufacturers

use

RED METALS CO. SEAL

aluminum tooling plate

DOUGLAS NORTHROP NAA LOCKHEED BOEING C-V CONVAIR

Investigate . . .

The advantages of low cost Red Seal Plates and Bars for your tooling requirements. Call or write for this new Red Seal Aluminum Products Brochure.

RED SEAL METALS CO.
10035 BURTIS STREET *Dept. A*
SOUTH GATE, CALIFORNIA
LOrain 6-5105

AVIATION SAFETY

CAB Report on Business Lodestar Crash

One-Engine Procedure Not Used

THE ACCIDENT

A Lockheed Model 18-56 Lodestar, N 9201H, owned by John Fox, publisher of the Boston Post, crashed nine miles southeast of Glastonbury, Conn., Nov. 5, 1954, at approximately 1942.[1] Of the five persons on board, the co-pilot was killed, the pilot seriously injured, and the three passengers received minor injuries. The aircraft was destroyed by impact and fire.

HISTORY OF THE FLIGHT

At approximately 1845, Nov. 5, 1954, N 9201H departed La Guardia Airport, New York, on a VFR (Visual Flight Rules) flight to Logan Airport, Boston, Mass. The crew consisted of Capt. John K. MacKenzie and Co-Pilot Whitney H. Welch. The passengers were Robert W. Mudge, Raymond J. Halloran, both airline pilots, and Mathew C. Abbott, an electrical engineer. Climbing to an altitude of 3,500 feet MSL (mean sea level), the flight proceeded toward Boston.

Approximately 12 miles southeast of Hartford, Conn., the right engine became very rough and backfired frequently. The captain was unable to correct this condition and later feathered the right propeller when in the vicinity of Willimantic, Conn. A wide right turn was made from a northeasterly to a northwesterly heading toward Bradley Field, Windsor Locks, Conn. Communication was established with Bradley Field and the flight was cleared for a straight-in approach to Runway 33.

The aircraft descended to 2,500 feet MSL during the turn and thereafter continued descending on a northwest heading until it struck trees and crashed. Nearby residents quickly reached the scene, gave assistance and notified authorities.

The Bradley Field 1930 weather was: Scattered clouds at 4,500 feet, visibility 15 miles plus, temperature 40 degrees, dewpoint 32, wind northwest 6 mph. La Guardia weather at the time of departure was: Ceiling unlimited, visibility 15 miles plus. Conditions en route were clear with excellent visibility.

INVESTIGATION

The accident occurred approximately 9 miles south-southeast of Glastonbury, Conn., and approximately 25 miles south-southeast of Bradley Field.

When N 9201H struck the tops of the trees it was on a northwesterly heading and in a descending right-wing-low attitude. Initial ground contact was at an elevation of 705 feet MSL and about 500 feet from the first trees struck by the aircraft. The right wing tip struck first, then the right engine, nose of the aircraft, and left engine, followed by a 180-degree rotation of the aircraft to the right and a short skid rearward.

The crew members and one passenger were thrown out of the aircraft. The other two passengers, with the help of the passenger who had been thrown clear, were forced to break the window of a jammed emergency exit in order to leave the aircraft.

While en route, Capt. MacKenzie invited the airline pilot-passengers to the cockpit to observe the flight operation. Mr. Mudge came forward first and noted during his visit that the aircraft was at 3,500 feet MSL on a heading of approximately 65 degrees with an indicated airspeed of 180 mph., 28 inches of manifold pressure, and 1,900 rpm.; mixture controls were in the auto-lean position with some left engine carburetor heat.

Shortly before the engine difficulty began Mr. Halloran went forward, took the left seat, and watched while Co-Pilot Welch flew the aircraft.

When the engine roughness developed Capt. MacKenzie, who was then in the cabin, immediately went forward, and took the left seat and control of the aircraft and Mr. Halloran returned to the cabin. The right propeller was feathered after efforts to smooth the engine failed. Left engine and propeller controls were advanced to 31 inches manifold pressure and 2,100 rpm. with full rich mixture and no carburetor heat. Small advances of engine and propeller controls were made on the operative engine during the descending right turn and the last increase was to 36-37 inches manifold pressure and 2,300 rpm. This last advance was made at 1,500 feet MSL but it gave no noticeable improved flight performance. Capt. MacKenzie testified as to this sequence of events.

Mr. Mudge testified that he had moved to a position behind the crew and noted that the heading on the directional gyro was 300 degrees and that the aircraft was at an altitude of 2,500 feet, descending at a rate of 200 or 300 feet per minute. Also the manifold pressure was 32 inches and the airspeed was 140 mph. At this time the town of Willimantic was a few miles to the right. The co-pilot acted upon the suggestion of Mr. Mudge and tuned one ADF receiver (automatic direction finder) to the Hartford low frequency range station. He was also advised of a field (Rentschler) just beyond the station. Capt. MacKenzie agreed to the suggestion.

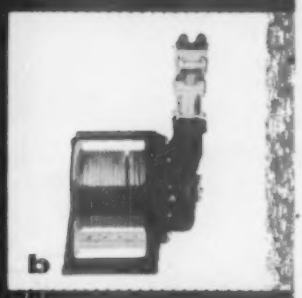
When Mr. Mudge noted an altitude of only 950 feet (250 feet above the ground) and an indicated airspeed of 95 mph. he "ran" to the cabin and took a rearward facing seat, realizing the crash was imminent.

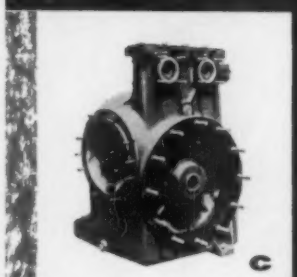
Both engines were torn from the airframe and the aircraft nose section was demolished during impact. Although no witness observed fire in either engine on the ground, there was evidence of a small flash fire near the left engine. Sections of the right wing were found scattered beyond the main wreckage area. Fire destroyed the fuselage

[1]All times herein are Eastern Standard and are based on the 24-hour clock.

WESTERN GEAR

a


b


c

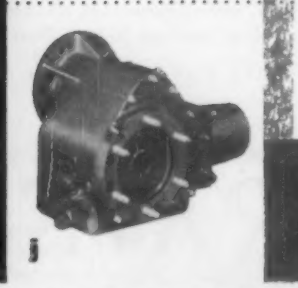
d

e

f

g

h


i

j

The design and manufacture of gears, gear drives and specialized equipment for aircraft use is a major activity at Western Gear. Since the first days of mechanized flight, Western Gear designers and engineers have played an increasingly important part in the production of components for mechanical or automatic operation of aircraft.

Virtually every major military or commercial aircraft today utilizes one or more Western Gear units. We are proud to be known as an important supplier to practically every major aircraft manufacturer. Our staff of engineers and designers are nationally regarded as experts in the field of aircraft mechanical power transmission.

Our plant facilities are unequalled and we are equipped for all types of machining and manufacturing operations, including experience with such new metals as titanium.

a Airborne cable drum type hoist, hydraulic or electric drive. Holds 150 feet of cable, lifts and lowers 800 pounds at 50 feet per minute.

b Cable drum type actuator: spooling capacity 20′ of ¼″ cable. Maximum cable pull 6500 lbs. Variable speeds available. Hydraulic motor powered. Direction, reversible.

c Turbine powered auxiliary power unit: one of the many types of turbine powered designs produced by Western Gear engineers. Unit shown provides main reduction with integral accessory drive pads.

d Generator drive: mounts on gas turbine driving two generators for auxiliary power supply. Utilizes self-contained pressure lubrication system.

e Horizontal stabilizer actuator unit: AC and DC powered providing three speeds for manual, autopilot and coarse control.

f Rotary actuator: one of hundreds of basic designs. Unit illustrated powered by both hydraulic and electric motors.

g Radar equipment: typical example of Western Gear precision unit made specifically for radar equipment.

h Fine pitch precision gearing: designed and produced for electronics, aviation and rocketry.

i Starter drive: one of our probe type starter drives developed to reduce airborne equipment weight.

j Accessory drive gear box: for use in conjunction with starter shaft for transmitting starting power to engines.

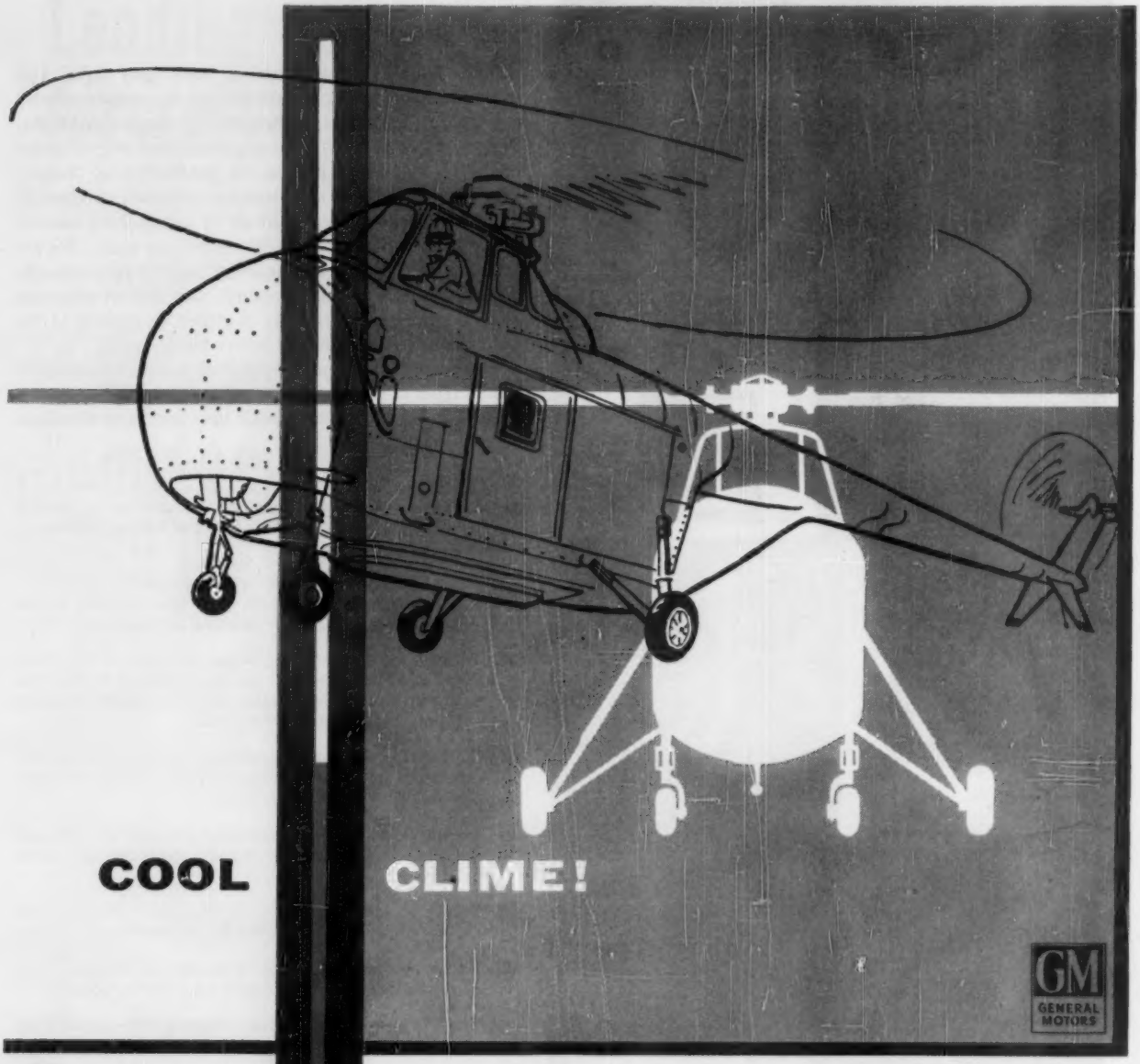
Sixty-six years of experience in the production of gears and special machinery, whether prototype or production line unit, can be invaluable to you in the solution of your problem. This store of knowledge is available for immediate help without obligation. Feel free to call on us at any time for information. Address inquiries to Executive Offices, P. O. Box 182, Lynwood, California.

"The difference is reliability" • Since 1888

WESTERN GEAR

PACIFIC-WESTERN PRODUCTS | POWER TRANSMISSION GEARS • MACHINERY •

PLANTS IN LYNWOOD, PASADENA, BELMONT, SAN FRANCISCO (CALIF.), SEATTLE AND HOUSTON • REPRESENTATIVES IN PRINCIPAL CITIES



Arctic or Tropics . . . Indiana or Indonesia—the 'copters are flying everywhere . . . *and flying cool* with Harrison on the job!
On long hauls or short hops . . . on every type of rugged 'copter assignment, Harrison oil coolers are keeping transmission and engine temperatures at just the right levels. What's more, Harrison oil coolers are designed to save space and weight . . . vital factors for quick take-offs and heavy cargo hauling. With its unexcelled research facilities, Harrison is always looking for new ways to make aircraft heat exchangers lighter, more dependable, more durable!
If you have a cooling problem, look to Harrison for the answer!

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N.Y.

TEMPERATURES MADE TO ORDER

HARRISON

and right wing. All survivors testified that there was no fire until after ground impact. Careful examination of the structure revealed no evidence of fire in flight nor failure or malfunction of controls prior to the impact.

Disassembly and examination of the two propellers revealed that the approximate blade angles of the left propeller were 25 degrees and the right propeller blade angles were 78 degrees, this latter being near the full feathered position. There were no indications of mechanical failure or malfunctioning of the two propellers or their control assemblies.

Disassembly of the right engine revealed that the rear throw clamping surface and the mating surface of the crank pin were severely galled and fretted from looseness and shifting of the crankshaft. Rollers and roller retainers of the main bearing were mutilated. The power section was severely damaged with all pistons either lodged in the heads of the cylinders or broken up and found in the power section.

Disassembly of the left engine revealed evidence that the cylinders, pistons, and valves had been operated at above normal temperatures. No. 1 cylinder exhaust valve was excessively burned; the guide and boss were missing and the bent valve stem and weakened valve spring gave evidence of excessive operating temperatures.

An airbox test of the carburetors revealed an abnormally lean mixture in the one for the left engine. Pilots and mechanics who had operated the engines stated it had been necessary to use carburetor heat for left engine smoothness. A flow bench test of the left carburetor revealed a normal fuel flow. Disassembly of the left carburetor AMC (automatic mixture control) revealed that the needle was extended beyond its normal position causing a lean mixture. A slight melting of the solder on top of the AMC bellows was noted.

The aircraft and engine logs were destroyed by the fire. The surplus engines installed on different dates in N 9201H were not supplied with logs when they were purchased "as is." The true amount of time on the engines since overhaul is unknown and cannot be determined. The engines were logged as zero time since overhaul, after a partial teardown and inspection was made following their purchase. Since then the left and right engines had 479 and 170 hours, respectively, at the time of the accident.

The gross weight of N 9201H at takeoff has been computed at 17,970 lb., which is 530 lb. under the maximum allowable gross weight of 18,500 lb. Fuel consumed during the flight to Glastonbury reduced the gross weight approximately 500 lb.

Capt. MacKenzie had flown approximately four years as copilot on the subject aircraft and one year as pilot in command. His command pilot time on the aircraft was about 200 hours. He stated, as did the former pilot in command of N 9201H, that they had simulated single-engine flight on several occasions. His record also reflects that he was either pilot or co-pilot on Lockheed aircraft during numerous ferry flights across the North Atlantic in World War II. It was testified that Co-Pilot Welch had two short periods of employment as a co-

THE WORLD'S LARGEST PRODUCER OF READY-TO-INSTALL POWER PACKAGES FOR AIRPLANES INVITES YOU TO ENJOY YOUR WORK *AND* YOUR LIFE IN *beautiful* SOUTHERN CALIFORNIA

We believe we can offer you an opportunity to improve your position in the business world – and improve your way of life here at Rohr Aircraft Corporation in beautiful, temperate, exciting Southern California. To strengthen our personnel in various departments, Rohr has a real opportunity for you if you are skilled as an –

ENGINEER (Aircraft Design or Structures) LOFTSMAN
JIG & FIXTURE BUILDER TOOL PLANNER TOOL DESIGNER

ROHR AIRCRAFT CORPORATION

Please write giving complete details and we will answer immediately.

Mr. Ned DeWitt, Personnel Department 16
Rohr Aircraft Corporation
Chula Vista, California

9 miles south of San Diego on sunny San Diego Bay.

$ave costly material and machining time by using Edgewater rolled steel rings

Cross-section designs are accurately formed during the rolling of Edgewater weldless steel rings, so that usually very little subsequent machining is needed. This reduces manufacturing cost, and saves material. Diameters, 5 inches to 180 inches.

Write for descriptive booklet.

EDGEWATER STEEL COMPANY
PITTSBURGH 30, PA.

Twist Wire *3 Times Faster* with

ROBINSON WIRE TWISTERS

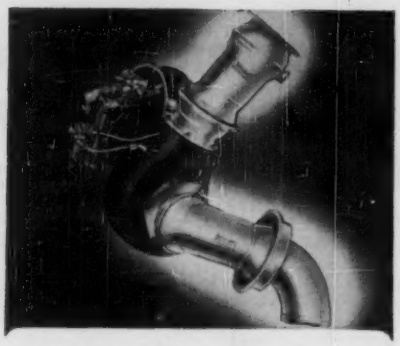
Split second whirling action safety wires 3 engines in time required for one by any other method. Saves as much as $140 per engine assembled.

3-Tools-in-1: Pliers . . . Cutters . . . Twisters. Side cutting. Permanent bronze bearing. Jaws lock on wire, can't slip off.

Used throughout the world for all aircraft assembly and maintenance.

9" Slendernose, wt. 12 oz. $19.50
12" Standard, wt. 15 oz. $20.50

Unconditional Guarantee! Write for details. RALPH C. ROBINSON CO., Box 494B, North Sacramento 15, Calif.



A precision ball joint connector designated & developed by Skyline

SKYLINE

PRECISION SHEET METAL & MACHINE PARTS
COMPLETE ENGINEERING SERVICE
A.F. CERTIFIED SPOT WELDING & OTHER WELDING PHASES
ELECTRONIC PARTS AND EQUIPMENT
AIRCRAFT FABRIC COVERING
GALLEYS AND COMMISSARY EQUIPMENT
GROUND SERVICING EQUIPMENT

SKYLINE PRODUCTS INC.

GRAND BOULEVARD, DEER PARK, NEW YORK

ARE YOU GOING NUTS OVER YOUR BOLT PROBLEM?

You don't need a magic lamp...
...you need AIRCRAFT BOLT CORPORATION!

Write for Complete Descriptive Catalog

AIRCRAFT BOLT CORPORATION

Specialists in manufacturing precision aircraft bolts and studs

701 N. Garvey Blvd., El Monte, Calif.

● SAFETY

pilot on DC-3 equipment before his employment as the Fox Lodestar co-pilot.

ANALYSIS

The Lockheed Aircraft Corp. operating instructions for Lodestars state under the heading "Single-Engine Emergency Operation: In the event of failure of one engine in climb, cruise, or descent, there is seldom need for maximum power from the operative engine unless the airspeed has decreased below approximately 90 mph.

"(a) Set the mixture control in the auto-rich position, the propellers to give 2,500 rpm., and adjust the throttle to give a manifold pressure varying from 41.8 inches at sea level to 37.3 inches at 6,900 feet. . . .

"(b) Feather the inoperative propeller and set the carburetor mixture control in idle-cutoff.

"(c) Set the carburetor heat adjustment to cold unless icing conditions exist.

"(d) Trim the airplane with rudder tab control.

"(e) Turn fuel system engine selector valve to operating engine only.

"(f) Correct selector for vacuum pump and turn and bank.

"(g) Reduce the manifold pressure to give a low power output as is consistent with safe operation."

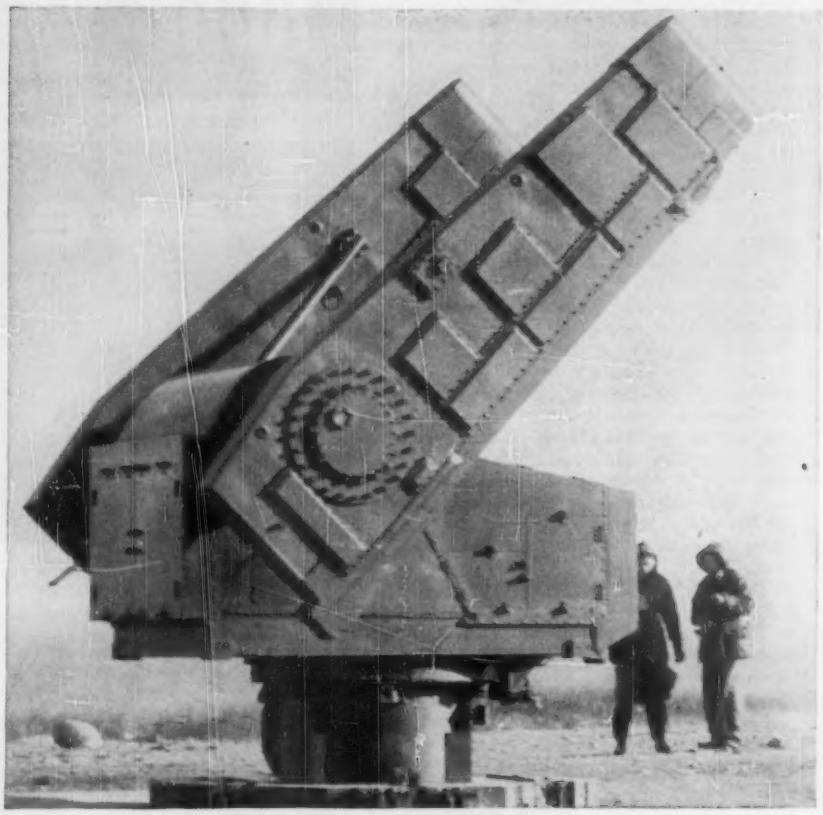
This same instruction manual under "General Flight Data" states that "at 17,500 lb., the single-engine ceiling is 16,300 feet and the indicated airspeed for maximum rate of climb, one engine, sea level, is 117 mph."

Further it is an accepted practice for a pilot, with an engine out to immediately use rated power on the remaining engine until single-engine flight with minimum loss of altitude is established. Power can then be reduced to optimum aircraft performance.

As testified to by the pilot, and an observing passenger, power was only increased by small increments during the entire loss of altitude and airspeed. Even the last increase, immediately prior to the crash, was only to a power setting considerably below the initial setting specified for single-engine operation in the Lockheed manual. Had the accepted technique been used it is believed the aircraft could have been flown to an available airport.

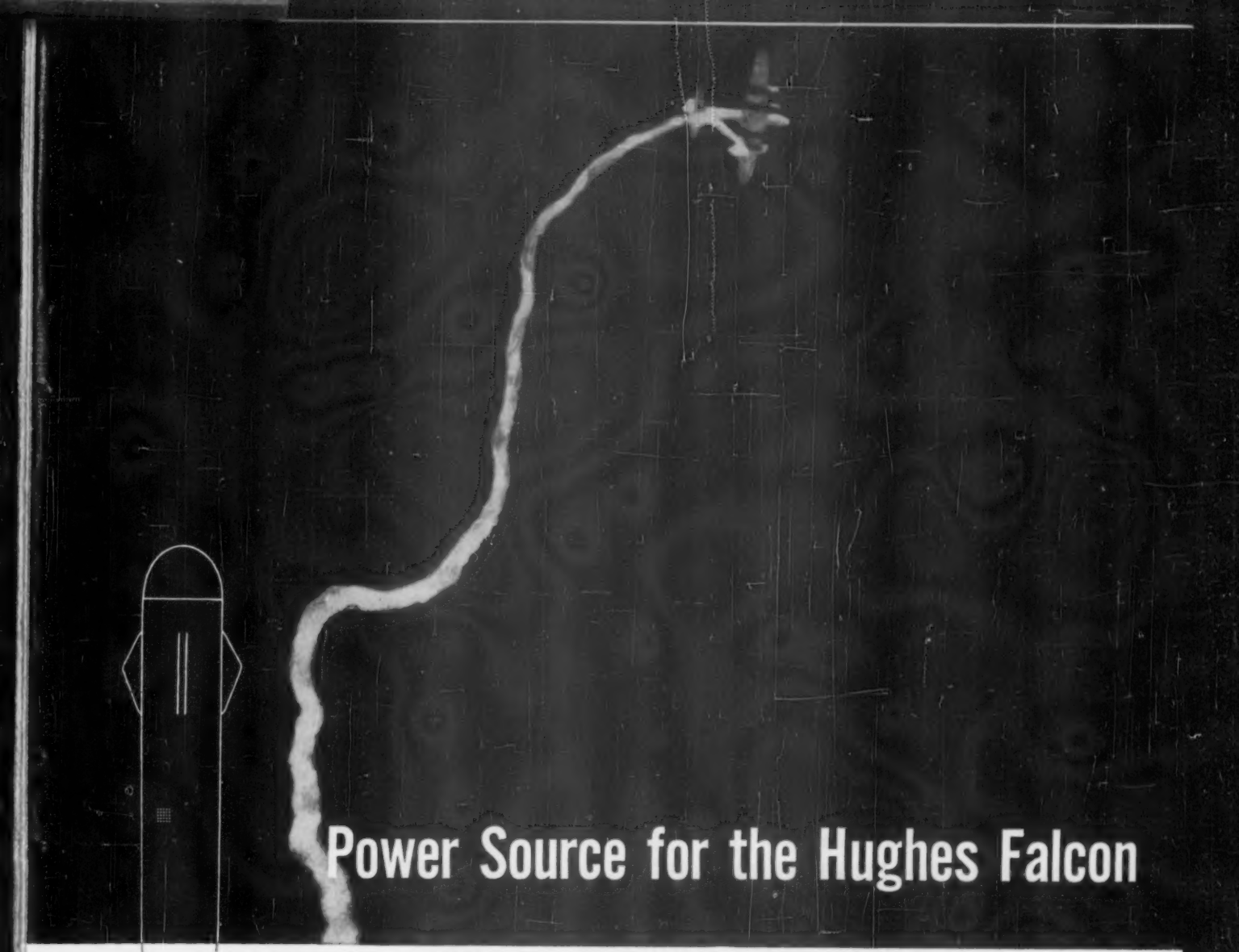
It is apparent that there was ample opportunity for the captain to have become thoroughly familiar with correct single-engine procedure on this aircraft.

The condition of the right engine rear throw clamping surface indicated some fault

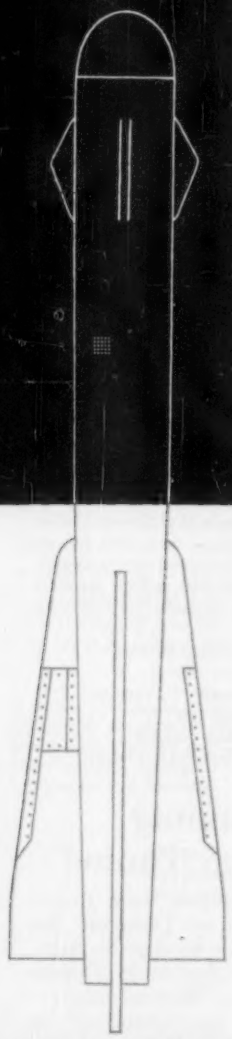


EMPTY LAUNCHER

This missile-less launcher is for shipboard use, probably with the Convair Terrier anti-aircraft missile system. Navy's Bureau of Ordnance sponsored the design and manufacture of the launcher by the W. L. Maxson Corp. Side arms, shown elevated, support the missile and booster; launcher is reloaded by semi-automatic techniques developed from standard Navy ammunition-handling methods.



Power Source for the Hughes Falcon



. . . a Thiokol® solid propellant rocket

The Falcon, designed and built by Hughes Aircraft for the United States Air Force, is one of the smallest air-to-air guided missiles in production. It is launched from interceptor planes and is capable of pursuing and destroying enemy bombers taking evasive action.

The power required to launch and propel the Falcon from an interceptor is supplied by a "Thiokol" solid-propellant rocket motor.

Development of the Falcon motor is the result of close teamwork between Thiokol, Hughes Aircraft and the Armed Services. Thiokol is also engaged in other programs that provide our Armed Services with improved solid-propellant rockets adapted to specific operational requirements.

SOLID PROPELLANT PROPULSION AND POWER UNITS FOR:

ALL TYPES OF ROCKETS	GAS GENERATORS
GUIDED MISSILES	AIRCRAFT ASSIST TAKE-OFF UNITS
BOOSTERS	SHORT DURATION POWER PLANTS

ENGINEERS AND CHEMISTS

Become a member of Thiokol's rocket development and manufacturing team! We welcome inquiries from mechanical engineers, chemical engineers and chemists interested in the rocket field.

Thiokol Chemical Corporation

SYNTHETIC RUBBERS • PLASTICIZERS • CHEMICALS • ROCKET MOTORS

780 NORTH CLINTON AVENUE • TRENTON 7, NEW JERSEY

Elkton Division, Elkton, Md. • Redstone Division, Huntsville, Ala. • Longhorn Division, Marshall, Tex.

ENGINEERS AND SCIENTISTS

You'll find at

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

ENGINEERING FOR THE FUTURE

CAREER OPPORTUNITIES EXIST IN:

AERODYNAMICS

Aero-Analysis — Theoretical Aerodynamics
Performance — Experimental Aerodynamics

AEROPHYSICS

Stability and Automatic Control — Armament Analysis
Aero-Electronics — Electronic Computing

PROPULSION

Propulsion Research — Propulsion Development
Environmental Controls Systems Development

NUCLEAR PHYSICS

Theoretical Nuclear Physics
Experimental Nuclear Physics

STRUCTURES ENGINEERING FOR AIRCRAFT

Stress Analysis — Flutter and Dynamics
Structural Research — Structural Loads

DESIGN for AIRCRAFT and NUCLEAR APPLICATION

Airframe Structures — Electrical
Thermodynamics — Electronics
Mechanisms — Equipment Design
Power Plant Installations

ENGINEERING TEST

Flight Test Instrumentation — Data Reduction
Fluid Dynamics—Electronic, Electrical—Structural

It is required that applicants for these positions have formal education in Aeronautical, Mechanical, Civil or Electrical Engineering, Physics or Mathematics—or professional experience in one of the fields above.

At CONVAIR you have an excellent opportunity to do graduate work—in plant or in evening college. CONVAIR offers liberal travel allowances, paid vacations, excellent insurance and retirement programs.

Send Resume to M. L. TAYLOR
CONVAIR, Engineering Personnel Dept. NN
FORT WORTH, TEXAS

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

FORT WORTH, TEXAS

in the installation of this part at a time prior to purchase of the engine.

The condition of the left engine as revealed by disassembly indicates that there was available to the pilot less than normal power at all settings. Although the left engine was not developing normal power for each power setting, it is believed that there was sufficient power remaining so that flight could have been maintained had the pilot used accepted single-engine procedures.

Had the pilot made a different turn at the time of the engine failure the resultant shorter distance might have enabled the aircraft to have safely reached Bradley Field despite the consistent loss of altitude.

Although a thousand feet of altitude was unnecessarily lost during the initial part of the emergency there was still sufficient time and altitude to establish correct single-engine performance. This was borne out by the fact that when the northwest heading was established the aircraft was still at 2,500 feet and descending at only 200-300 feet per minute. This rate of descent continued down to 200 feet above the ground at which time the indicated airspeed was only 95 mph.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The crew and the aircraft were properly certificated.
2. There was no fire prior to impact.
3. Weather was not a factor in the accident.
4. A structural failure occurred in the power section of the right engine that necessitated feathering of the right propeller.
5. Failure to attain single-engine performance resulted in loss of altitude.
6. Mechanical difficulties in the left engine reduced power but remaining available power was sufficient for single-engine performance.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was that after failure of the right engine, accepted single-engine procedure was not followed, which resulted in the aircraft losing altitude and striking the ground.

By the Civil Aeronautics Board:

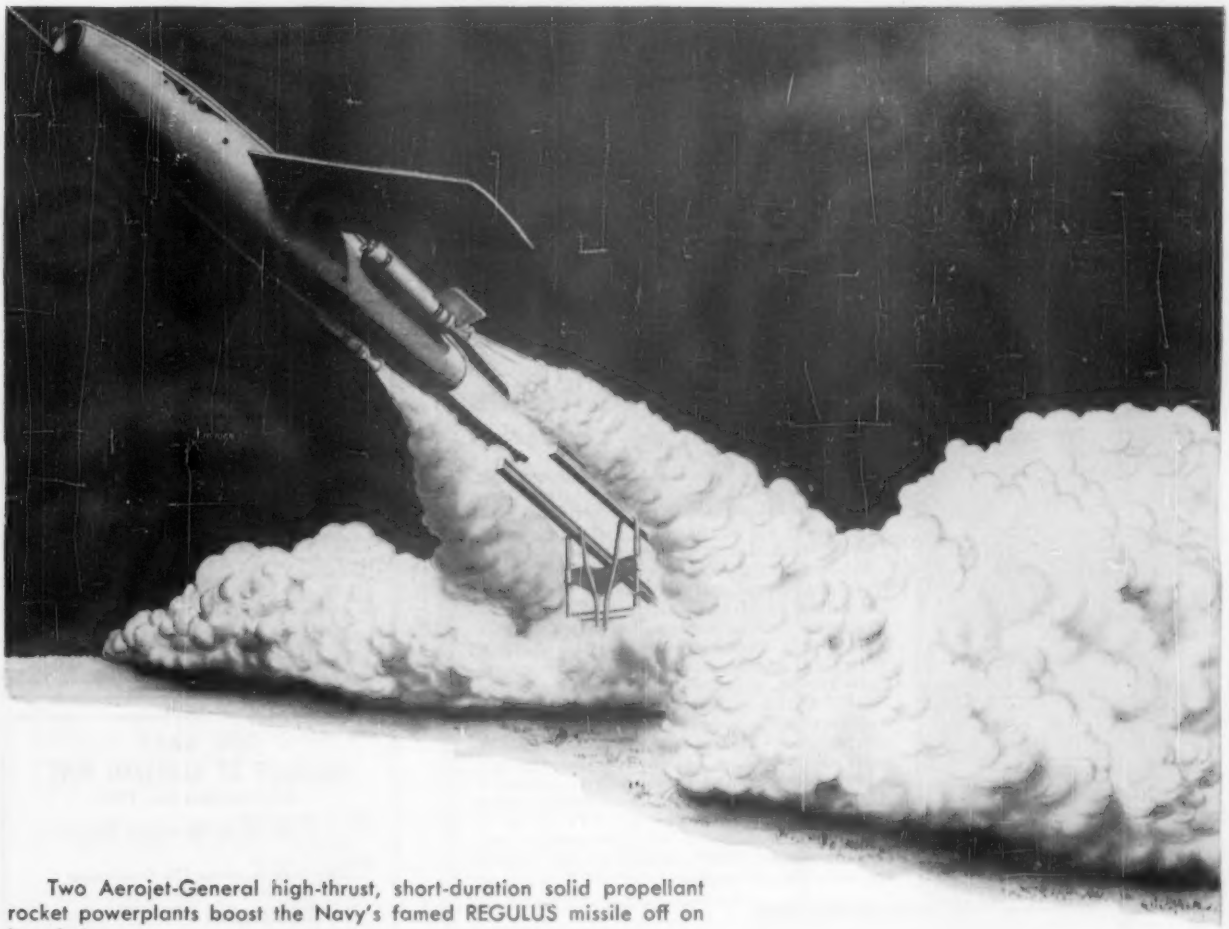
Ross Rizley
Joseph P. Adams
Josh Lee
Chan Gurney
Harmar D. Denny

Israelis Planning Mach 1.5-4.5 Tunnel

Tel-Aviv—A highspeed wind tunnel is to be purchased by Technion, the Israel Institute of Technology at Haifa, for aerodynamic studies in its Department of Aeronautical Engineering.

Speed range of the tunnel will be from Mach 1.5 to 4.5. Highspeed photographic equipment will be installed.

The Department is headed by Prof. Sydney Goldstein, a well-known British aerodynamicist.



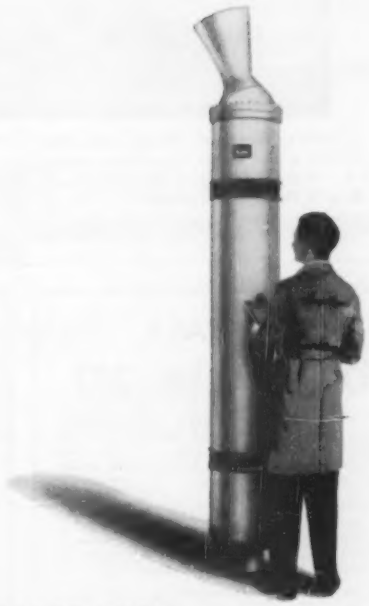
Two Aerojet-General high-thrust, short-duration solid propellant rocket powerplants boost the Navy's famed REGULUS missile off on its mission.

Built by Chance-Vought, the REGULUS is one of a growing number of available missiles for defensive or offensive applications.

This booster was tailor-made for REGULUS. Proven reliability, producibility and low cost make it another example of Aerojet-General's unparalleled experience in development and production of rocket powerplants.

Aerojet-General supplies liquid and solid propellant rocket powerplants, auxiliary power units, gas generators, or other associated equipment to a major part of America's missile program.

Since the first JATO was produced by Aerojet-General in 1942, the company has delivered over 350,000 JATOs and boosters ranging in thrust from 250 pounds to 100,000 pounds.



• Solid- and Liquid-Propellant Rocket Powerplants for Missile and Aircraft Applications • AeroBRAKE Thrust Reversers (SNECMA) • Auxiliary Power Units and Gas Generators • Electronics and Guidance • Ordnance Rockets • Explosive Ordnance and Warheads • Underwater Propulsion Devices • Architect-Engineer Services for Test Facilities

AEROJET-GENERAL NEEDS:

CHEMICAL ENGINEERS, CHEMISTS, ELECTRONIC ENGINEERS, MECHANICAL ENGINEERS, PHYSICISTS AND AERONAUTICAL ENGINEERS

Aerojet-General CORPORATION

A SUBSIDIARY OF THE GENERAL TIRE & RUBBER COMPANY

THE GENERAL TIRE

AZUSA, CALIFORNIA
SACRAMENTO, CALIFORNIA

MORE POWER FOR AIR POWER

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** :EQUIPMENT :USED OR RESALE

UNDISPLAYED —RATES— DISPLAYED

$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Position Wanted undisplayed advertising rate is ½ the above rates payable in advance.

Box Numbers count as one line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Closing Date: 11 *days before issue date.*

The advertising rate is $18.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns, 30 inches to a page.

Employment Advertising: New Employment Opportunities Section for Displayed ads starting July 4th issue. Rate $23.35 per inch, unless on contract. Ads are subject to Agency Commission.

D 18 S BEECHCRAFT

FOR SALE **FOR LEASE**

Serial A-216. Mfd May 1946. 2900 Hours total time. 100 hours engines and hydromatic propellers SMO. Dual instruments, 80 gallon nose tank. Slinger rings. Windshield Wipers. Flux Gate compass. Excellent radio which includes: Dual Collins VHF with R.M.I. and I.L.S. Bendix A.D.F., Range Receiver, Glide Slope, Marker Beacon, etc. Excellent condition.

ATLANTIC AVIATION CORP.
Teterboro Airport Teterboro, N. J.
Phone: Hasbrouck Heights 8-1740

Deluxe Executive Lodestar

• **Engines:** New Wright R1820-72A, test run time only—Engine accessories, zero time since overhaul • **Propellers:** Hamilton Standard 6511-A-12S Mirror finished, full-feathering • **Fuel System:** Latest CAA-approved dual type; 160 gallon auxiliary fuel tank installed • **Brakes:** High pressure, disc type • **Radio:** 1 Bendix (50 watt) RTA-1B transceiver, 1 Collins ARC-1 50 channel VHF transceiver, 1 Wilcox (50 watt) 440A VHF transmitter-receiver, 2 Bendix R5/ARN 7 ADF systems, 1 Collins integrated flight system, 1 Collins 51R-3 omni receiver, 1 ARC F-11A isolation amplifier, 1 Pioneer fluxgate compass system, 2 M1-51A Bendix cockpit speakers • **Cabin:** Craftsman RC-10 AM-FM radio with four Altec Lansing speakers, Cockpit-cabin interphone and public address system • **Airframe:** Knife-edge installation and bat wings removed • **True Air Speed:** 225 MPH at 9,000 ft. • **Passengers:** 10 • Complete anti and de-icing system. High pressure oxygen system for crew and passengers.

We own the aircraft we offer!

Call, write or wire: Herrol Bellomy, executive vice president or Mert Madden, aircraft sales manager, L. B. Smith Aircraft Corporation, International Airport, Miami 48, Florida—Phone 64-0611.

L. B. Smith AIRCRAFT CORPORATION

FOR SALE

$80,000 Stock—Precision Equipment

• GAUGES
• DIAL INDICATORS
• MICROMETERS
• TOOLMAKER'S MICROSCOPES
• HARDNESS TESTERS
• SURFACE PLATES
• SIMPSON METERS
• COMPARATORS
• PROFILOMETERS
• SIGNAL GENERATORS

Used only in classroom instruction. Excellent condition. Substantial discount. Bids invited, all or part.

PITTSBURGH TECHNICAL INSTITUTE
GRant 1-0985
1204 PENN AVE. PITTSBURGH 22, PA.

FOR SALE
EXECUTIVE DE HAVILLAND DOVE

Manufactured May 1952

721:45 total time
200:10 since top overhaul with Simplex Rings
ARC-15C Omini
ARC-17 VHF Receiver T11 Transmitter
ARC-5 40 Channel Transmitter
MN-31 ADF
Glide Slope Receiver
Fresh License
Dual American Instrument Panel

Write or Wire:
KING RANCH
P. O. Box 1151 Kingsville, Texas

Immediate Delivery from PAC

The industry's largest stock of engines

R 985-AN14B R 1830-92, -75, -94
R 200-7M2, -11M3 R 2800-31, -75
*R 2800-C, -CA, -CB

(* immediate delivery on most models)

PAC Warranty—PAC Quality

Pacific Airmotive Corporation
Burbank, Calif. Linden, N. J.
BRANCHES:
California: Chino, Oakland Kansas: Kansas City
Washington: Seattle Colorado: Denver

FOR SALE
FOUR MARTIN 202

36 wide passenger seats. Cabin public address system. Complete galley. Pratt & Whitney R-2800 CA-15 engines. Hamilton Standard 43E60 aluminum bladed, full feathering, reversible propellers.

Following life time:

N° 261: 7,000 hours since new (approx.)
N° 262: 6,500 hours since new (approx.)
N° 263: 5,000 hours since new (approx.)
N° 264: 7,000 hours since new (approx.)

All were completely overhauled at 4,000 hours.

Would accept barter for DC-4s. with following characteristics:

Model: A, with 1800 gallon capacity.

Engines: R-2000 7M2.

Seating arrangement: 58 passengers.

WRITE TO: LINEA AEREA NACIONAL
CASILLA 147-D
SANTIAGO CHILE

ENGINE WORKS

Lambert Field Inc. St. Louis

Largest supplier of engines for executive DC3. We stock, overhaul, and install—

SUPER-92

Wright	Pratt Whitney
R1820	R1830
-202, -56, -72	-75, -92, -94

Also R2000-D5, -13 R1340 R985

DC3 Owners—write for our DC3 engine evaluation form, and engine exchange plan.

FOR SALE

500 new Bendix ignition coil boosters—type 513-M-24 volts
Lots of 100 $2.35 each

One (1) complete Generator test stand manufactured by U. S. Electrical Motors

A. HELLER
210 Snediker Ave. Brooklyn 7, N. Y.

P&W 985-AN-1 and AN-3 Engines

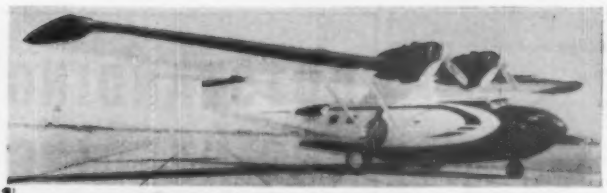
N.T.S. Army O.H. Complete with Carb. Mags, Harness and baffles. Crated and ready for shipment. $1000.00 each F.O.B. Norfolk, Va.

Contact **W. CLAYTON LEMON**
Woodrum Field Roanoke, Va.
Phone 6-1341

NEED A GENERATOR

30V 140 Amp Aircraft
30V 200 Amp Aircraft
and many others
L-3, M-2, M-3, O-1, O-3

Contact
GEORGE A. BUCHANAN
Tel. 6-3078
2504 Oakville St. Alexandria, Va.



CAA APPROVED REPAIR STATION—NO. 4069

AIRFRAME—All Classes; RADIO—Class 1, 2 and Limited; ACCESSORIES—Class 1 and 2; INSTRUMENTS—Class 1, 2 and Limited.

Dealers for Lear, Collins & Bendix Radio and Eclipse-Pioneer Instruments

SOUTHERN CALIFORNIA AIRCRAFT CORPORATION
Ontario International Airport
Ontario **California**

EXECUTIVE AIRCRAFT OF ALL TYPES

- Conversions
- Modifications
- Overhaul
- Maintenance

Originators of the "LANDSEAIRE" Executive Conversion of the PBY-5A Amphibian

FOR SALE

3 BOEING STRATOLINER 307 B 1
Equipped for 54 passengers—enlarged entrance door.
Price per Airplane:...58.000 £.

3 CURTISS COMMANDO C 46 F
Equipped for 44 passengers.
Price per Airplane:...30.000 £.

4 DOUGLAS C. 47
Equipped for 27 passengers.
Price per Airplane:...21.000 £.

2 BRISTOL 170 MARK 31
Made in 1954—less than 1.000 hours flying time since new.
Price per Airplane:...75.000 £.

ALL TWELVE AIRCRAFT STILL BEING OPERATED. IMPORTANT STOCK OF SPARES FOR EACH AIRCRAFT TYPE.

AIGLE AZUR INDOCHINE
70 Champs-Elysees Paris 8e, France

ENGINEERS

Outstanding professional opportunities for specialists in mechanical design analysis are now available immediately with a new and expanding department of General Electric's Aircraft Gas Turbine Division located in the Boston area.

Qualifications for these positions are graduate study in mechanical engineering or applied mechanics with emphasis on solid mechanics. Equivalent professional experience may be substituted.

SUPERVISOR—Design Analysis

To supervise Design Analysis Unit with direct responsibility to the Manager-Design Engineering, including advice and counsel to him on soundness of engine design. Will have responsibility for mechanical engineering design procedures, design criteria, and mechanical analysis of small aircraft gas turbine engine designs. Will advise various units of the engineering organization on methods for determination of stress, vibration, and other mechanical design information, and will conduct detailed design analyses on engine and engine components.

ENGINEERS—Design Analysts

Four positions are now open for experienced design analysts. To prepare and interpret design requirements, design analyses, and successful criteria for development engines. Will be expected to perform stress and vibration analyses on engines and component parts to assist design activities on special problems involving various phases of mechanical engineering.

Qualified applicants are invited to send resume to:
Mr. David Price—Small Aircraft Engine Dept.

GENERAL ELECTRIC
1000 Western Avenue, West Lynn, Mass.

1951 EXECUTIVE DeHAVILAND DOVE
for lease

Deal Directly With Owner

No deposit no long-term contract.

Fly as much as you like. $1750 per month. Aircraft hull insurance included.

On outright purchase, will not be undersold.

TRADE AYER COMPANY
Linden Airport, Linden, N. J.
Linden 3-7690

WANTED

HELICOPTER PERSONNEL

PILOTS: EXPERIENCED ON BELL OR HILLER EQUIPMENT

MECHANICS: EXPERIENCED ON LINE OR OVERHAUL MAINTENANCE

Excellent opportunity for qualified personnel in expanding operation. Located in pleasant climate down south. Wages based upon experience and qualification.

Give complete information in first letter including C.A.A. ratings held, breakdown of experience, etc. Include recent photo if available. Write

P-6692, Aviation Week
520 N. Michigan Ave., Chicago 11, Ill.

ENGINEERS

Creative Opportunities with Republic Aviation

Aerodynamics

SENIOR AERODYNAMICIST Airflow specialist experienced in interpretation of high speed flow phenomena. Anlytic background. To do work on the control of high speed aircraft.

Dynamics

DYNAMICS ENGINEER A broad program involving analytical and experimental investigations of the complex dynamics problems associated with supersonic aircraft offers a real opportunity for young engineers with ability. You will gain invaluable experience under competent supervision to develop a professional background in such areas as servo-mechanisms, analogue computers, control system dynamics, non-linear mechanics and hydraulic system analysis. A program of laboratory investigations on actual systems in conjunction with analytical work, as well as a coordinated lecture program, offers an outstanding environment for rapid professional development. A degree in ME, AE or Physics with good Math background is preferred.

Flight Test

FLIGHT INSTRUMENTATION ENGINEER Experience with oscillographic and electronic flight installations preferred, ground experience accepted. Openings for a senior and junior position are available in a growing department.

MATHEMATICIAN For Flight Test Engineer position. Math education required, aircraft experience preferred. To work on application of automatic computing procedures for flight data. An opportunity to develop new techniques in an expanding field.

Research

SENIOR RESEARCH ENGINEER—STRUCTURES B.S. degree in aeronautical engineering or applied mechanics with minimum of 3-5 years experience in structural development and theoretical stress analysis. Work includes theoretical and experimental analyses of problems in thermal stresses, structural stability, creep-buckling and fatigue.

COMPUTER ENGINEER To supervise maintenance and to design special circuitry for computers. Experience with either analogue or digital computers required. College graduate preferred.

SENIOR POWER PLANT ENGINEER Three to eight years aircraft power plant experience. Capable conducting power plant testing in conjunction with jet engine and induction system analysis. B.S. in M.E. or A.E.

Thermodynamics

Specialized openings for Thermodynamics engineers in the following categories, B.S. in M.E. or A.E. required.

THERMODYNAMICS ENGINEERS (1) Two years experience in high speed gas flow. (2) Two years experience in heat transfer.

Flutter & Vibration

DYNAMICS ENGINEER Responsible position open for work in flutter analysis of supersonic aircraft. Good environment of qualified people and adequate equipment provide means for gaining valuable experience in the field of aeronautical engineering. Mathematics or engineering degree required. Very good opportunity for advancement.

Stress Section

SENIOR STRESS ANALYSIS METHODS ENGINEER B.S. or M.S. in aeronautical or civil engineering, with advanced mathematics background and with a minimum of 3 years experience in airframe stress analysis, or structural methods.

Aircraft Design

ARMAMENT STAFF ENGINEER Aircraft armament systems analysis. Analyses and evaluation of offensive and defensive systems, weapons effectiveness, aircraft vulnerability, delivery technique studies. Must be self-starter with initiative, requiring little supervision. Requires degree in Math or Physics, ability to prepare reports and deliver presentations.

Please address complete resume, outlining details of your technical background to:

Assistant Chief Engineer
Administration
Mr. R. L. Bortner

REPUBLIC AVIATION
FARMINGDALE, LONG ISLAND, NEW YORK

OUTSTANDING ENGINEERING OPPORTUNITY

Are you a specialist or a recent graduate proficient or interested in one or more of the following fields?

- **Aero-Thermodynamics**
- **Internal Aerodynamics**
- **External Aerodynamics**
- **Ballistics**
- **Ram Jet and Turbo Jet Test and Performance**
- **Transonic and Supersonic Design and Test Operations**
- **Turbine and Compressor Design**

Sverdrup & Parcel, Inc. is engaged both nationally and internationally in design and consultation of advanced and unusual areonautical test facilities which require the theory and application of these special fields. The wide variety of our work, embracing the design and review of industrial development facilities, offers challenging problems and provides excellent opportunity for individual development and advancement.

Starting salary and extent of responsibility are dependent upon individualy ability and experience. Fringe benefits include: an unusually attractive Employee Benefit Plan which furnishes insurance features and provides for retirement; paid vacations, holidays and sick leave; overtime rates; and an employees' club which offers interesting social and practical values. Two accredited universities offer opportunity for advanced education.

Your letter of inquiry will receive prompt attention and reply. Please write to—

SVERDRUP & PARCEL, Inc.
Consulting Engineers
915 Olive St. Louis 1, Mo.

AIRPLANES WANTED

Need 50 Bonanzas, Navions, 180's, 190's, 170's, Aero Commanders, Twin Navions, Twin Beeches, etc.
Will Buy Dealers' Stocks New or Used
Vest Aircraft Co.'s Skyranch
BOX 5306, DENVER 17, COLORADO

SPARKPLUGS WANTED

Surplus or used aircraft sparkplugs wanted. Highest prices paid for R.B. 19R, 48SS2, 5/2, 5/3, 5/4, 5/5, 23R, 27-R, 23, 21282, 31282; R.P. 43S; LE 44, 45; L.S. 48; A.C. 181, 281; R.S. 19-2R, 14-1R; R.C. 9R; R2-14-R; R-214; R.N. 5/3; 590S2, 61382 63S", 64S.
RADIO & ELECTRONICS SURPLUS
13933-9 Brush St. Detroit 3, Mich

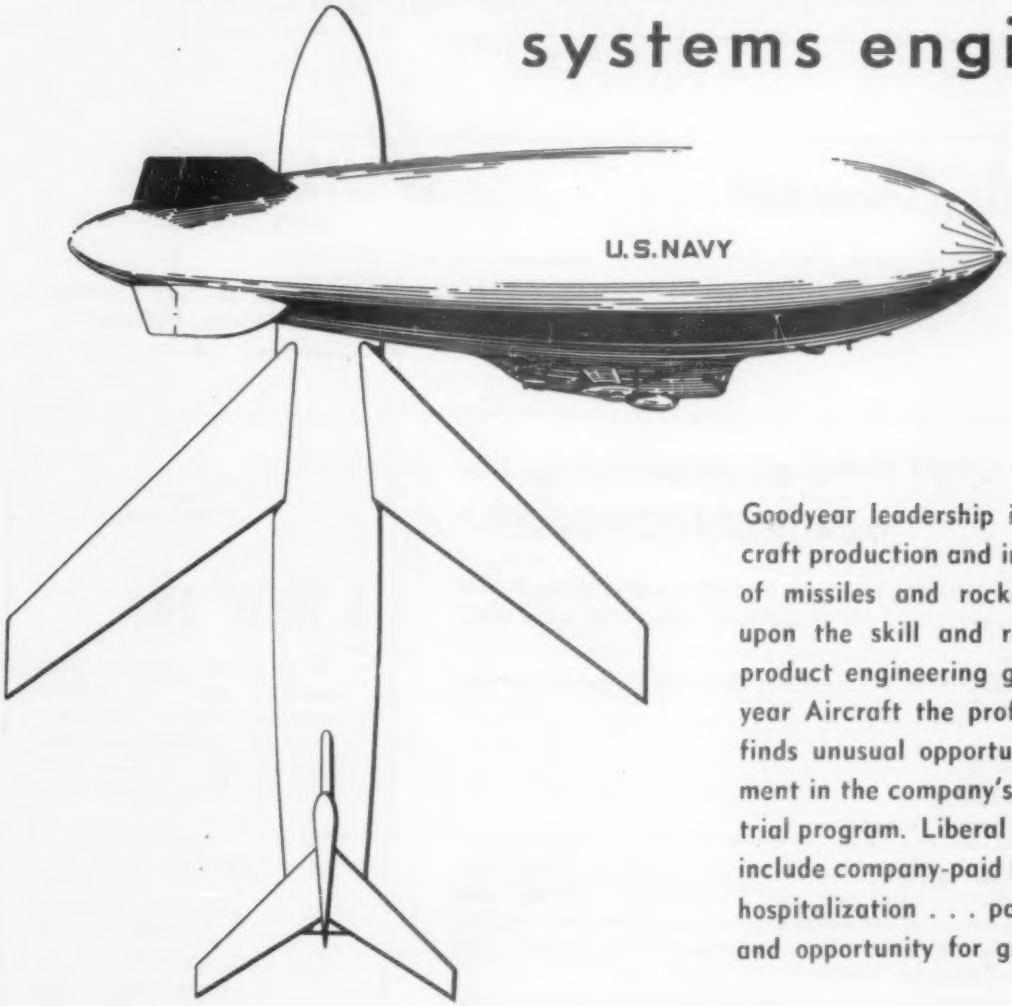
We Buy DC-3 and C-47

—also components, fuselages, center sections. Prefer runout or needing work, airline, passenger, or cargo, Pratt & Whitney or Wright. State price, time, quantity, type engines.
We are not brokers
REMMERT-WERNER, INC.
Lambert Field St. Louis, Mo.

If there is anything you want
that other readers can supply
OR . . . something you don't want—
that other readers can use—
Advertise it in the
SEARCHLIGHT SECTION

Mechanical engineers with a knowledge of hydraulic systems and high-response servo mechanisms are needed at once to assist with new configurations now being developed.

hydraulics and control systems engineers



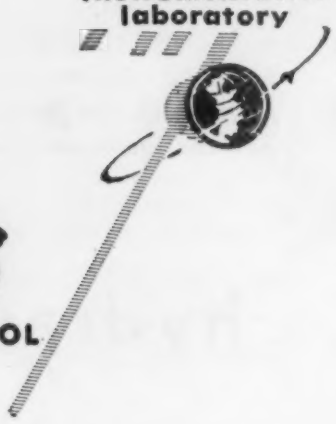
Goodyear leadership in lighter-than-air craft production and in the development of missiles and rockets is dependent upon the skill and resourcefulness of product engineering groups. At Goodyear Aircraft the professional engineer finds unusual opportunity for advancement in the company's diversified industrial program. Liberal employee benefits include company-paid life insurance and hospitalization . . . paid vacations . . . and opportunity for graduate study.

Goodyear Aircraft has immediate openings for graduate engineers in every field. Write today for an application form, or ask about openings in your classification.

C. G. Jones, Mgr.
Salary Personnel

GOODYEAR
GOODYEAR AIRCRAFT CORPORATION
1210 MASSILLON ROAD, AKRON 15, OHIO

MIT
Instrumentation Laboratory



RESEARCH

ENGINEERS

INERTIAL GUIDANCE AND WEAPONS FIRE CONTROL

- SYSTEMS
- COMPONENTS

Graduate Courses

MAY BE TAKEN FOR ACADEMIC CREDIT

WHILE EARNING **FULL PAY**

Write

MARTIN PHILLIPS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
INSTRUMENTATION LABORATORY
68 Albany Street CAMBRIDGE 39, MASS.

is YOUR FUTURE as promising as a HELICOPTER'S?

We think the future of the *helicopter* is virtually unlimited. Why not make *your* future just as promising?

SIKORSKY, pioneer helicopter manufacturer, needs . . .

TEST ENGINEERS
DESIGN ENGINEERS
DEVELOPMENT ENGINEERS

to do important work in the fascinating and fast-growing helicopter field. Expanding military and commercial requirements are a challenge to skilled men—offer excellent opportunities to further your professional stature.

Engineers whose abilities or experience qualify them for these responsible positions will enjoy a well-rewarded career with a secure future and many benefits for themselves and their families.

Send a complete resume to R. L. Auten, Personnel Department

SIKORSKY AIRCRAFT

Bridgeport 1, Connecticut

A NEW ERA . . . .

In in-flight refueling, pioneered by Flight Refueling Inc., has created several challenging openings for qualified engineers in the following categories:

AERODYNAMICIST
AIRCRAFT HYDRAULICS SPECIALIST
AIRCRAFT ELECTRICAL SYSTEMS ENGINEER
FUEL SYSTEMS ENGINEER
AIRCRAFT STRUCTURES ENGINEER

Send your inquiry to:
Milton S. Cole, Employment Supervisor

Flight Refueling, Inc.
FRIENDSHIP INTERNATIONAL AIRPORT
Baltimore 3, Maryland

ADVANCE YOUR POSITION IN GUIDED MISSILE ELECTRONICS

Apply your wealth of engineering experience at RCA!

PROJECT ENGINEERING

You will direct and coordinate the work of a group charged with developing complex systems. You'll administer programs which result in systems that meet military requirements. Your wide experience in equipment development and design, and sound management background will be fully utilized.

Project Engineering Fields include:

Radar • Data Handling and Transmission • Computers

SYSTEMS ENGINEERING

Advanced Systems Analysis—You will create from basic military requirements new guided missile systems which utilize the latest advances in electronics. Close contact is maintained with basic research developments at RCA and other research centers.

Systems Development—You will view systems as a whole in order to anticipate and optimize problems. You'll develop design criteria for major components which increase operational reliability of over-all systems. Your broad technical experience and thorough understanding of the systems approach will be applied.

ENJOY ALL OF RCA's DESIRABLE CAREER ADVANTAGES . . .

Please send resume of education and experience to:

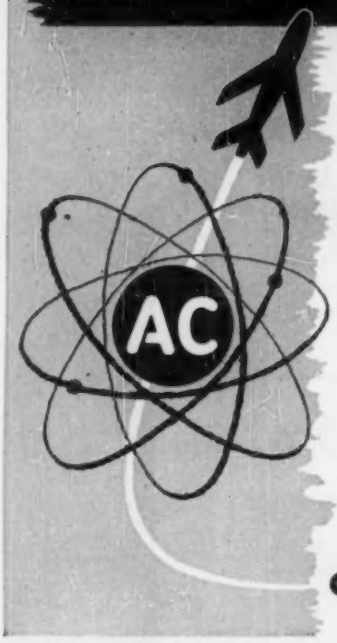
Mr. John R. Weld
Employment Manager, Dept. B-2F
Radio Corporation of America
30 Rockefeller Plaza
New York 20, New York

RCA

RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DIVISION

ENGINEERS and DESIGNERS NEEDED

for: MISSILE GUIDANCE SYSTEMS · BOMBING NAVIGATIONAL COMPUTER SYSTEMS · NEW CIVIL AVIATION PRODUCTS · JET AND TURBO-PROP ENGINE CONTROLS · AIRBORNE FIRE CONTROLS



GM CAREER OPPORTUNITIES IN

Systems Engineering and Analysis
Experimental Engineering
Development Engineering
Project Coordination
Design Engineering
Product Engineering
Product Evaluation
Field Engineering

AND WE ALSO NEED:

DESIGNERS · CHECKERS · LAYOUT MEN

Positions Are Permanent — Excellent Advancement Opportunities

Every inquiry treated confidentially and given immediate attention and personal reply.

WRITE TODAY FOR EMPLOYMENT APPLICATION

Mr. Louis R. Berks
Supervisor of Employment

AC SPARK PLUG DIVISION
Precision Instrument Plant

GENERAL MOTORS CORPORATION
Milwaukee 2, Wisconsin

Allied Research

Allied Research has several important positions available on its engineering and research staff for engineers and physicists with experience and a desire to advance in the fields of:

AEROMECHANICS:
Problems include theoretical, model, and full-scale experimental investigation of the aeroelastic response of aircraft and missiles, analytical and experimental studies of thermal-induced stresses in thin and thick panels, and special topics in vibration analysis, testing and control.

AERO/THERMODYNAMICS:
Studies now in progress include non-steady aerodynamics involving problems in lift growth over high-speed airfoils, transient drag loading and shock wave diffraction, aerodynamic heating of aircraft and missiles, and thermal radiation and other heat transfer processes.

PHYSICS:
A wide variety of theoretical and experimental problems including radiation transport phenomena, the effect of high temperatures on physical properties, and applications of modern electronics techniques to classical physics.

The current openings are for staff and senior positions with a growing and select organization of consulting engineers and scientists. The problems are organized on a project basis so that each engineer is keenly aware of the overall objectives of the program, and the wide variety of problems prevents over-specialization within any given field. Prospective employees will find a progressive research-minded management that cooperates to produce unimpeded fulfillment of the technical goals of the scientific staff and the individual. Please send resume of education and experience to: Mr. D. J. Fink, Chief Project Engineer,

ALLIED RESEARCH ASSOCIATES, INC.,
43 LEON STREET, BOSTON, MASS.

ENGINEERS
...work on **JET VTO**
at **RYAN**

The development of the dramatic new jet-powered VTO airplane is one of the many exciting opportunities which await you at Ryan—situated in sunny Southern California. All inquiries to the Administrative Engineer are strictly confidential.

OPPORTUNITIES FOR:
Flight Test Engineers
Flight Test Analysts
Electronics Engineers
Systems Analysts
Engineering Designers
Aerodynamicists
Thermodynamicists

RYAN
AERONAUTICAL COMPANY
San Diego 12, California

SALES REPRESENTATION WANTED

In Canada, Ohio, Georgia, and Missouri. By one of the four US-gov't approved airplane control pulley manufacturers. Write, give complete details on your contacts, experience accounts serviced, and present lines handled.

PACIFIC MOLDED PULLEY CO.
1520 W. 139th St. Gardena, Calif.

SKILLED
PILOTS
AVAILABLE
No Fee to Employers
PILOTS EMPLOYMENT AGENCY
Teterboro (N. J.) Airport
Hasbrouck Heights - 8-1091

"Opportunity" Advertising
Think
"SEARCHLIGHT"
First

PAA

PAN AMERICAN

WORLD AIRWAYS

NEEDS PILOTS

Career Opportunities with the World's Most Experienced Airline

NOW OPEN
to qualified applicants!

MINIMUM QUALIFICATIONS:

1. U. S. Citizen age 21-30.
2. 750 command hours.
3. CAA Commercial Pilot's License, with instrument rating.
4. 2 years college.
5. Satisfactory Company Physical Examination.
6. Satisfactory references.

Company training at New York base with salary during training.

Write: Chief Pilot
Pan American World Airways
N. Y. International Airport
Jamaica 20, New York

SERVICE TO 6 CONTINENTS AND AROUND-THE-WORLD

Honeywell Needs Research and Development Engineers for Aerodynamics and Inertial Guidance

If you're an experienced engineer who wants challenging, satisfying work involving the most advanced concepts of aircraft and missile control, there's a place for you in Honeywell's Aeronautical Division—where accelerated growth and a wide variety of products have made many new openings.

Positions Open

1. Aircraft Stability and Control Engineers are needed to do original research in control analysis for aircraft and missile stability. Includes development of analytical techniques, advanced control systems and concepts, autopilot systems analysis and aerodynamics. Autopilot experience desirable, but not necessary.

2. Inertial Guidance Engineers are needed for analytical and experimental work in this new field; opportunities are unusual. Involves development of new techniques applicable to gyros, accelerometers, platforms, computers, and inertial systems. Experience in theoretical and applied mechanics, vibrations, electronics, servos, or precise measuring instruments is desired.

3. Design-Development Engineers are needed for the formation of new design teams in these important fields: *Autopilots; Hydraulics; Gyros; Servos; Electronics.*

You'll Like Honeywell

Generous employee benefits include paid vacations and holidays, broad company-paid insurance, pension, and hospital plans for your protection.

Liberal tuition allowance for graduate studies at University of Minnesota, a leading engineering college and home of the Minneapolis Symphony. Only five minutes distant.

Salaries are first-rate, as are Honeywell's modern technical facilities. We pay your travel and family moving expenses.

You'll Like Minneapolis

No commuting; enjoy country living in residential areas just ten minutes away from your work. Good hunting and fishing, comfortable resorts in surrounding areas.

Live in a city of beautiful lakes, friendly neighbors, fine recreation: sailing, canoeing, skiing, skating. Public golf courses.

Write Today

Give us an outline of your experience. Address your letter to:

JOHN HILL
Engineering Placement Manager
2753 Fourth Avenue South
Minneapolis, Minnesota

MINNEAPOLIS
Honeywell

Aeronautical Division

ENGINEERS

LONG-RANGE CONTINUING OPPORTUNITY FOR ELECTRICAL AND MECHANICAL

ENGINEERS

AT

Bendix

OPENINGS EXIST FOR. . .

LIQUID PROPELLANT ROCKET CONTROLS ENGINEER

Mechanical or electrical engineer to supervise the research and development of liquid propellant rocket controls, systems design, component design, development and testing.

CONTROL ENGINEER

Requiring an engineering degree in electrical engineering or math and physics, plus at least three years of experience in design analysis of feedback control systems. Should be familiar with frequency response methods as applied to feedback control synthesis. Analog computer and simulator experience highly desirable. Activity is in the field of aircraft and missile power plant controls including gas turbine, ram jet, and rocket types. Controls are largely hydro-mechanical. The fuel metering research facility includes an analog computer and jet engine simulators.

MAGNETIC AMPLIFIER SYSTEMS ENGINEER

Electrical engineer supervisory capacity on research and development of magnetic amplifier circuitry, control systems, and component design and testing, supervising other engineers and technicians. The salary of these positions will be determined by your ability and experience.

Send detailed resume listing education, engineering experience, and salary requirement to:

Technical Employment Department S.B.
Bendix Products Division of
Bendix Aviation Corporation
401 North Bendix Drive
South Bend 20, Indiana

We guarante you an immediate reply -

SUNDSTRAND AVIATION

Has Opportunities for

DESIGN ENGINEERS
MECHANICAL ENGINEERS
ELECTRICAL ENGINEERS

to Design and Develop

MECHANICAL-HYDRAULIC CONSTANT SPEED SYSTEMS

Please address complete resume, outlining details of your technical background to

MR. HOWARD EKSTROM
Personnel Director—
SUNDSTRAND AVIATION
2531 11th, Rockford, Illinois

SPECIAL SERVICES TO THE AVIATION INDUSTRY

AIRCRAFT DEALERS

CONSULT LUND FIRST
when buying or selling
COMMERCIAL AND MILITARY AIRCRAFT, ENGINES, PROPELLERS, ACCESSORIES, INSTRUMENTS, RADIO, SPARE PARTS
With trained technicians and our own inventories we are geared to give you service with SPEED!
BOTH BUYERS AND SELLERS LOOK TO US!
Lund Aviation, inc.
230 Park Ave., N.Y.C. MUrray Hill 9-3620

EXECUTIVE TRANSPORT AIRCRAFT
All Models
BEECHCRAFT LOCKHEED
CONVAIR GRUMMAN
DOUGLAS CESSNA
AERO COMMANDER
WELSCH AVIATION CO.
60 East 42nd Street, Suite 729
New York 17, New York Murray Hill 7-5884

OVERHAUL & MAINTENANCE

REMMERT-WERNER, Inc.
Lambert Field St. Louis, Mo.
offer your choice of

1 DAY	2 DAY	3 DAY
100 hour INSPECTIONS	OR	100 hour OVERHAULS

for
BEECHCRAFT DC-3 LODESTAR

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1111 Wilshire Blvd. (17)

POSITION WANTED

Pilot, age 29, ATR DC-3, C-46, S & MEL & S instructor, good hours. Have A&E plus most ground ratings, desire corporation type flying, available two weeks notice. PW-6862, Aviation Week.

SELLING OPPORTUNITY WANTED

Sales Engineering, by air, to the airframe, engine, and instrument fields. Aero Sales Company P.O. Box 53 Caldwell, N. J.

WANTED

Wanted Basic Lockheed Lodestars and Douglas DC-3's and C-47's for overhaul and conversion. Send information to L. V. Emery, Executive Aircraft Service, Inc. P. O. Box 7307, Dallas 9, Texas.

SPECIAL SERVICES

PARTS & SUPPLIES

R. K. Brown Co.
PARTS SPECIALIST
STROMBERG INJECTION CARBURETOR
CARBURETORS PARTS ASSEMBLIES
CARBURETORS SUPPLIED IN REPAIRABLE CONDITION OR OVERHAULED AND CERTIFIED BY CAA APPROVED REPAIR STATION.
Parts also available for Holley Carburetors
238-A PARK AVE. EAST RUTHERFORD, N. J.
WEbster 9-9250, 9-9251 Cable Address "Brownaro"

NAVCO INC.
Lambert Field St. Louis, Mo. PErshing 1-1710
Has all Parts and Supplies for Executive DC-3 LODESTER BEECH
Airframe Engines Radios
A.R.C. Bendix Collins Lear Sperry Wilcox
P&W Continental Wright Goodrich Goodyear

INSTRUMENT SERVICE

RAS
ELECTRONIC SPECIALISTS
CUSTOM INSTALLATIONS OF
ARC . . BENDIX . . COLLINS
NARCO . . ECLIPSE . . SPERRY
LEAR
READING AVIATION SERVICE, INC.
MUNICIPAL AIRPORT READING, PA.

S. M. S. INSTRUMENT
Sales & Serv. Inc.
NY International Airport
Jamaica 30, N. Y.
CLASS 1, 2, 3, 4
unlimited
OL6-5678 TWX NY4-396

AERONAUTICAL ENGINEERS

An opportunity is offered for intelligent, imaginative engineers to join the staff of a progressive and self-sustaining, university-affiliated research and development laboratory. We are desirous of expanding our permanent staff in such fields as:

DESIGN STUDIES OF ADVANCED SUPERSONIC AIRCRAFT
ANALYTICAL & EXPERIMENTAL STUDIES OF AEROELASTICITY
HELICOPTERS MISSILES
AIRCRAFT STRUCTURES
CONTROL & STABILITY
WIND TUNNEL TESTING

Salary structure and benefit programs are on a par with industry. In addition, there are many tangible advantages, such as our self-sponsored internal research policy, of interest to men with ingenuity and initiative.

CORNELL AERONAUTICAL LABORATORY, INC.

Buffalo 21, New York

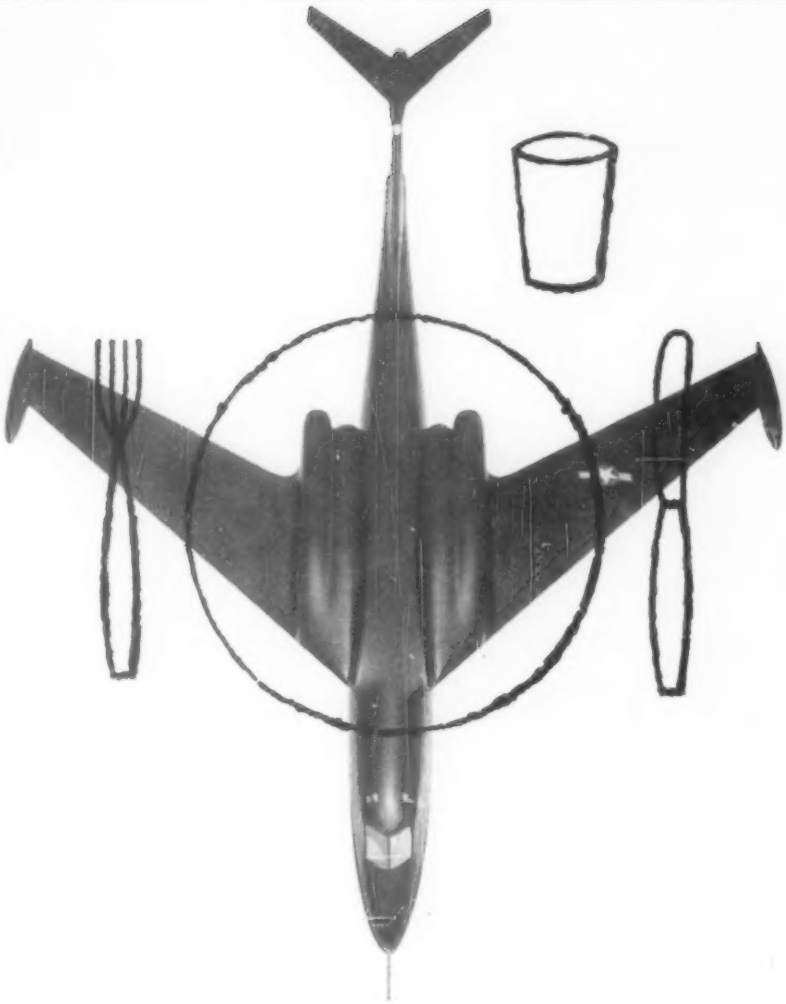
The Institute for Air Weapons Research can offer unusual opportunities to applied SCIENTISTS and to ENGINEERS with theoretical inclinations in the fields of

AERONAUTICS
and
ELECTRONICS

Our task includes the analysis and evaluation of the overall performance of AIR WEAPONS SYSTEMS

Write To

INSTITUTE FOR
AIR WEAPONS RESEARCH
UNIVERSITY OF CHICAGO
MUSEUM of SCIENCE and INDUSTRY
CHICAGO 37, ILLINOIS



food for thought

Do you know that the Navy's new Martin four-jet P6M Seamaster is one of the most talked-about developments in the aircraft industry today? Do you know why it may change our whole basic concept of military operations?

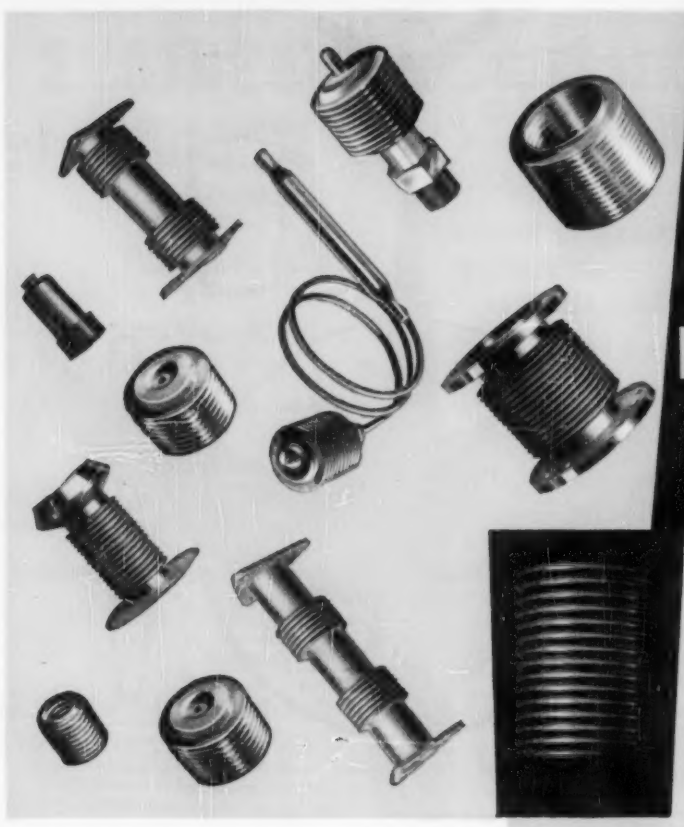
And are you aware of the *other* big things that have been happening at Martin in recent months ...and that are happening today?

Do you know what possibilities—futures—careers—these developments have created for engineers who value opportunity more highly than the status quo?

If not, you'd do well to write to J. M. Hollyday, Dept. A-6, The Glenn L. Martin Company, Baltimore 3, Maryland.

...and he will tell you the Martin story. No matter how limited or how extensive your background, you will find it food for thought.

MARTIN
BALTIMORE · MARYLAND

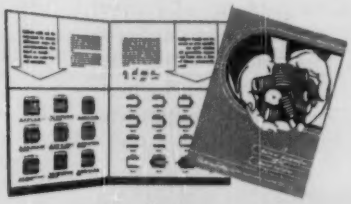


YOUR No. 1 SOURCE FOR COMPLETE BELLOWS ASSEMBLIES AND DEVICES

FULTON SYLPHON

BELLOWS HEADQUARTERS, U.S.A.

You gain three important advantages when you consult Fulton Sylphon, originators of the metal bellows—*1.* Over 50 years experience in bellows engineering is focused on your problem; *2.* Modern production facilities geared to good service; *3.* Cost saving opportunities through the design and production of complete bellows assemblies.



HERE'S HELPFUL INFORMATION

This 32 page catalog covers basic bellows engineering, conversion tables, metals available and other bellows data. Use the handy coupon for your free copy.

Mr. Controls®

Robertshaw-Fulton CONTROLS COMPANY

FULTON SYLPHON DIVISION

Knoxville 1, Tennessee

( ) Please have a Bellows Engineer call me for an appointment.

( ) Send me Bellows Catalog # MA-1400.

Name_____ Title_____

Company_____

Address_____

City_____ State_____

Seaboard Plans Atlantic Cargo Schedule

By Gordon Conley

New York—Seaboard & Western Airlines plans to operate six-day-a-week service between the United States and Europe when its North Atlantic airfreight certificate becomes effective in mid-August. The new flights will increase cargo competition among scheduled trans-Atlantic airlines, adding about 344,000 lb. a week to the total available airfreight capacity.

President Eisenhower approved Seaboard's five-year certificate June 16, ending S & W's eight-year fight for a scheduled operation. His decision, made in line with recommendations submitted by Civil Aeronautics Board 13 months ago, cleared away the last of major international air transport cases awaiting action at the White House.

The certificate authorized Seaboard to carry cargo from New York, Philadelphia and Baltimore to Newfoundland and Ireland. Beyond Ireland, the airfreight line can fly to West Germany via Britain, the Netherlands and Belgium and to Switzerland with stops in France. The service will receive no government subsidy.

60-Day Wait

S & W must wait 60 days before it can inaugurate scheduled North Atlantic flights. The interim period will give five carriers that protested CAB's recommendations – Transocean Air Lines, Pan American World Airways, Trans World Airlines, Overseas National Airlines and European-American Airways—a chance to try and reopen the case.

Last week, spokesmen for the three major airlines made these comments:

• **Transocean**—"I don't know for a fact whether we'll seek a petition for reconsideration. It's my personal opinion that the company's attitude now is that we're more interested in the Pacific, and it's quite possible we'll let the trans-Atlantic decision go by the board . . .

"I would think there's no doubt about TWA and PanAm petitioning for reconsideration."

• **Pan American**—"It's been a blow, but now we'll probably wait and see whether they can survive."

• **Trans World**—"We haven't decided what we will do."

The 60-day interim period also will give the Board time to examine bilateral agreements with countries on Seaboard's routes and to act on the airline's proposed plan for operating its new service.

S & W wants to start with six round trips a week between New York and Shannon, branching out from there to London, Amsterdam, Brussels and Frankfurt on one leg and to Paris and Zurich on the other.

Before flights can be inaugurated from Philadelphia and Baltimore, Seaboard must open offices in the two cities and decide the frequency needed.

Norden's Prediction

On outlook for the new operation's future, Executive Vice President Arthur V. Norden said: "I predict conservatively that we will increase our present volume by at least 100% during the first year."

Seaboard plans to buy new transports for its airfreighter fleet in the near future, and Norden indicated the order may go to Lockheed Aircraft Corp. for its new 1049H Super Constellation. It now operates four 1049D Super Connies and six DC-4s. Maximum payload for each S & W Super Connie is 37,000 lb. and 17,000 lb. for the DC-4s.

Airfreight Pact

To work out a possible cooperative agreement, Norden met last week with Airwork Atlantic President John V. Muhlfeld. The British carrier operates the only other scheduled all-cargo service between the United States and Europe (AW June 6, p. 128).

"Personally, I think Seaboard's certificate is a healthy sign," Muhlfeld said. What I'd like to see Seaboard do is join IATA (International Air Transports Assn.) and operate as a competitive partner.

"Working together, we could develop a sensible tariff structure and strengthen the whole North Atlantic airfreight operation. We'll have a common interest. We'll be the only all-cargo carriers in IATA.

"But if they stay out, all members will declare open war and take action against Seaboard collectively. I certainly

Why CAB Reversed Itself in Cargo Case

Washington, D. C.—Two major factors entered into Civil Aeronautics Board's decision last year to recommend a trans-Atlantic cargo certificate for Seaboard & Western Airlines, after ruling in 1951 that there was no need for the service. These were:

• Recent equipment developments, including the DC-6 and Super Constellation, makes the cargo operation economically feasible, while DC-4 cargo operations are not.

• Support of the Defense Department in favor of the cargo operation in the reopened case.

The decision's text made these points:

". . . Advantages of the certificated carriers necessarily require the new carrier to exercise diligent effort and promotional and developmental ingenuity in the creation of new markets for its services and in the provision of new service advantages to penetrate current markets. By the same token, the existing certificated carriers will necessarily be engaged in similar efforts.

"Out of the interplay of these competitive efforts, we expect the rapid expansion of the trans-Atlantic air cargo market, resulting in an economic new service and an increased net yield for the existing certificated carriers. Thus a new all-cargo service will help rather than hurt our existing United States trans-Atlantic carriers and will in no case enlarge the subsidy support required for these carriers.

". . . We are convinced that the new trans-Atlantic cargo service here being authorized will derive its principal support from cargo potential as yet untapped by the certificated carriers and not from revenues diverted from the certificated carriers.

". . . The clear indication is that the service and development of the cargo market is, to such carriers (PAA and TWA), of secondary or incidental concern as compared to their passenger service. So long as this is the case, the public interest requires that the United States be represented in this important field by a carrier that will have its primary interest focused on this development. Certification of a new carrier will give greater assurance of continued developmental effort and operation of all-cargo services. For such a carrier's very existence depends on the operation, and therefore there is every incentive to maintain the service."

3 REASONS WHY IT'S for Aircraft and

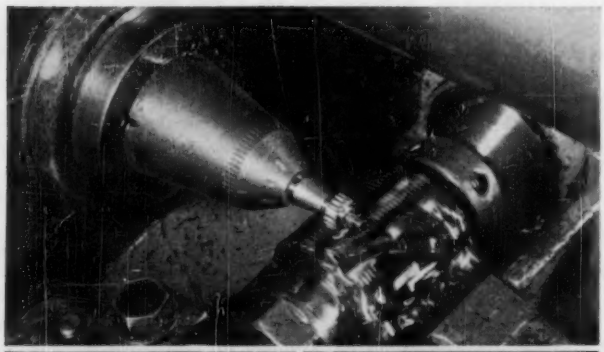
IN CHARGE OF SYSTEMS DEVELOPMENT at General Mills are Dr. Carl L. Kober (left) who was a top man on German radar and V2 teleguidance and also spent five years at Wright Air Development Center; and Dr. Howard H. Baller (right) who came to General Mills via Cal Tech, Inyokern, Fairchild Guided Missile division and W. L. Maxon Corp. Looking on is Dr. Cledo Brunetti, director of Engineering Research and Development, a national figure in electronics because of his work for the National Bureau of Standards, Stanford Research, General Mills, and the Department of Defense.

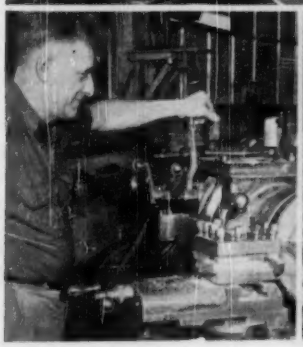
1. THE RIGHT PEOPLE

It takes a highly specialized kind of creative engineer to develop top-notch aircraft systems—guidance, navigation, bombing and fire control. At General Mills you get a complete staff of such specialists—men who have met and mastered problems just like those you are facing. In addition, our staff includes personnel trained in laboratory studies, prototype manufacturing and exacting performance testing. Top people in electronics, in mechanical research and in physics and chemistry research are also available for specific phases of any problem.

2. THE RIGHT EQUIPMENT

Our modern plants, with 400,000 sq. ft. of area, are completely equipped for exhaustive research, engineering and development work in addition to precision manufacturing. All types of operations in the manufacturing process, from raw materials to finished systems, can be carried out within our plants. The unusually high level of precision maintained often requires reworking of standard machine tools in our shops to maintain microscopic tolerances. All inspection and calibration work is done in dust-free, temperature-controlled rooms. Quality control is rigidly maintained through detailed inspection of all materials, manufactured parts and sub-assemblies.





AMONG THE SPECIALIZED EQUIPMENT in our plants are ultra-precise gear hobbing machines; big engine lathes (shown turning head end castings for the Y-4 bombsight); modern equipment for precision assembly and inspection.

General Mills Missile Systems...

HERE ARE SOME EXAMPLES of the precision electro-mechanical engineering and close-tolerance production services available to you at General Mills. The *Y-4 Bombsight* permits pinpoint bombing from fantastic heights; the *Coordinate Converter* links the Y-4 Bombsight with other elements of an aircraft's bombing system; the *Flight Recorder* maintains a complete flight record of velocity, acceleration and altitude; the *Autofab* Machine assembles electronic circuits automatically at high speed.

3. THE RIGHT EXPERIENCE

Besides manufacturing precision ordnance instruments since 1940, we have had broad experience in the development of aeronautical and industrial control systems. Our engineers have a first-hand understanding of the theoretical as well as the practical requirements of effective systems; we have developed several unique new weapons for the armed forces as well as feedback instrument systems for precision control of industrial processes and military operations. Other projects include highly complicated electronic and electro-mechanical airborne computing and control systems.

READY TO SERVE YOU . . . are complete facilities for electronic and electro-mechanical research, design, development, production engineering and precision manufacturing in connection with . . . ☐ automation ☐ aircraft systems ☐ industrial instrumentation and control ☐ specialized precision instrumentation ☐ navigation and missile control systems ☐ electro-mechanical computers ☐ remotely-controlled manipulators ☐ telemetering (radio and wire) ☐ fine-particle technology ☐ meteorological and high-altitude research. WRITE TODAY to Dept. AW-1, Mechanical Division of General Mills, 1620 Central Avenue, Minneapolis 13, Minn.

Job opportunities available for creative engineers. Work closely with outstanding men on interesting projects.

MECHANICAL DIVISION OF General Mills, Inc.

TRANS-CANADA AIR LINES REPORTS:

Traffic up 55%

in the first month of Viscount service on New York-Toronto route

Wherever the Viscount flies...traffic figures rise!

This statement has been dramatically proved in actual service by enterprising airlines all over the world. One of the most recent proofs of the Viscount's prowess as a traffic builder comes from Trans-Canada Air Lines.

In their very first month of operation, TCA's latest figures show that their new turbo-prop Viscounts carried 55.5% more passengers than did their piston-engined aircraft the preceding month . . . although the April capacity was only 38.3% greater! And in the same period of time, the passenger load factor rose from 76% to 87%.

In the 800 million passenger miles that Vickers Viscounts have flown throughout the world, they have consistently demonstrated an ability to reduce operating costs and increase load factors and profits.

The passenger appeal of Viscounts is unequalled in the annals of commercial aviation. They are faster, and have reduced flight times on major air routes by as much as 30%. They are more comfortable. Remarkably free from vibration and engine noise, the Viscount permits travelers to converse, rest, read or sleep with a new degree of ease and relaxation.

Behind the Viscount stands the great name and service organization of the Vickers Group—internationally famous as the makers of ships, industrial machinery, heavy tractors and precision equipment.

VICKERS

VISCOUNT

built by VICKERS-ARMSTRONGS
powered by ROLLS-ROYCE

VICKERS-ARMSTRONGS LIMITED
(Aircraft Division) Weybridge, England

United States Representative: Christopher Clarkson, 10 Rockefeller Plaza, New York 20, N. Y.

wouldn't want to fight 13 airlines."

Norden said his airline probably will join IATA and work side by side with its British competitor.

"With the combined services of both carriers, we can give maximum service to the shipping public," he said. "There's still a lot of work to be done on selling the idea of airfreight, and this needs cooperation."

On tariffs, Norden reported Seaboard would push its theory of specific rates for certain commodities.

"Certain commodities can stand certain rates," the S & W executive said. "If we can carry commodities at different tariffs, returns on the higher-rated goods will make it possible for us to carry other commodities that otherwise would not move by air."

Lockheed Offers New Airfreighter

Lockheed Aircraft Corp. is coming out with an all-cargo version of its 1049G Super Constellation. First order for the $1.8-million 1049H possibly will be placed by Seaboard & Western Airlines, only carrier to buy the 1049D airfreighter.

Other orders are expected from Slick Airways and Flying Tiger Line. Slick is the better prospect. It leased a 1049D from Seaboard during the first part of this year and indicated satisfaction with its performance.

Low Operating Cost

In its 1049H sales campaign, Lockheed is pushing an attention getter for cost-conscious airfreight carriers. "It will move more tonnage with greater ease than any commercial aircraft now available," the builder claims, "and it will do the job at the lowest cost per ton-mile in the world."

The company quotes these direct operating costs for trans-Atlantic flights with a five-man crew, full over-water configuration, a three-hour fuel reserve and against average yearly winds of 24 mph:

• **New York-Shannon,** 9.1 cents per ton-mile with a 28,300-lb. payload.

• **New York-Paris,** 10.67 cents per ton-mile with a 23,600-lb. payload.

Maximum payload for the 1049H will be 34,623 lb. Range with tiptanks and no fuel reserve is quoted at 5,580 miles and top level flight speed at 365 mph., equal to 1049G performance.

Greater Takeoff Weight

Biggest difference between the 1049H and the 1049D will be an integrally stiffened wing, allowing a higher gross takeoff weight. The 1049H will go up to 137,500 lb., while the 1049D's limit is 135,400 lb.

It will be powered by four 3,250-hp. Wright Turbo Compound 972TC18-DA3 piston engines. Predecessor is equipped with four Wright 972TC18-DA1s, also rated at 3,250 hp. The DA3 delivers 2,700 hp. in low blower meto, compared with 2,600 hp. for the DA1.

Like the 1049D Super Connie, the 1049H will convert to passenger configuration. But the new transport will carry only 92 aircoach passengers, compared with a 109 maximum for the 1049D. Seaboard figures conversion time for the earlier freighter at 24 hours.

Other features of both the 1049H and the 1049D include:

• **All-magnesium floor** that can carry loads of 1,000 lb. per linear foot or 300 lb. per square foot.

• **Floor tie-down fittings** arranged in a grid pattern. They provide for working loads up to 4,000 lb. in any direction, with no restriction on the angle of pull.

• **Optional equipment** such as weather surveillance radar and wingtip fuel tanks.

With its new certificate for scheduled trans-Atlantic cargo flights, Seaboard & Western Airlines will be able to attract financial backing for expansion.

Customer Testimonial

"The Super Connie is the best commercial long-haul airfreighter now available," says Arthur V. Norden, Seaboard's executive vice president. "The Douglas DC-6A is superior to the 1049D only on short hauls."

For nonscheduled North Atlantic flights, S&WA increased the maximum payload of its four Lockheed transports to37,000 lb. and operated them at a break-even load factor of 53%. Direct operating cost was approximately 10 cents per ton-mile.

Despite its confidence in Super Constellation freighters, Seaboard looks at both the 1049D and the 1049H as interim transports.

"Our end airplane will carry at least 50 tons or more," says Norden, "and it will have easy entrance and exit—cargo doors that will be ramp or truck-bed height.

"Cargo doors on the Super Connies are too high. It takes us an hour to load seven tons on the 1049D. As payloads get bigger, this ground time will kill us. A freighter like the Super Connie with a 50-ton payload would take more than seven hours to load."

Tiptanks Give Turboprop YC-121F 4,000-Mi. Range

Air Force's turboprop YC-121F, whose 440-mph. speed is billed as world's fastest for a prop-driven transport, has a range of 4,000 mi. with 600-gal. tiptanks shown in this flight view. Lockheed says the combination cargo personnel-evacuation carrier can airlift 8-ton load across the U. S. in under 6 hr. USAF is getting two of the ships and Navy two (R7V-2s). Nacelles of the four 5,700-hp. P&W T-34 engines are mounted high on wing.

German Bilateral Is Delayed As State Studies Criticisms

Washington, D. C.—Airline and congressional criticisms have caused a State Department reappraisal of the proposed bilateral air transport agreement recently negotiated with West Germany (AW June 20, p. 88).

State Department delayed a final decision last week on whether to sign or renegotiate the agreement while the Civil Aeronautics Board heard arguments from the airlines which would be affected. The carriers had complained they hadn't been sufficiently consulted in the negotiations, especially in reference to proposed rights for a German carrier to Latin America.

At the conclusion of a series of emergency hearings called to examine the bilateral route proposal and its method of negotiation, the Senate Interstate and Foreign Commerce Committee urged the Senate, State Department and CAB to re-examine the proposal before signing it.

State Position

CAB will advise the State Department on the economic aspects of the proposal, then State will make the decision whether or not to sign it.

The Senate committee heard testimony in open session from five airlines, CAB and the State Department before going into closed sessions to hear certain details of the negotiations which State refused to disclose in public hearings because of their sensitive nature.

In open session, Deputy Assistant Secretary of State Thorsten V. Kalijarvi denied that the granting of rights beyond New York to Latin America set a precedent that would have to be followed with all foreign airlines. He said that "only those who have what we want and need should obtain comparable benfits."

May Cause Restrictions

In reference to airline recommendations, Kalijarvi said that the carriers had emphasized the importance of obtaining the rights they now have in Germany, plus rights to operate beyond German points. The temporary authority to operate into Germany now held by Pan American World Airways and Trans World Airlines expires next year.

Kalijarvi told the committee that "the exclusion of the German and other European carriers from participation in the United States-South American market can only lead to the imposition of severe restrictions on the liberal operating rights which United States carriers operating to and beyond Europe now enjoy. Such a course of action would be a serious blow to the economic well-being of the United States international airline system and hence to the welfare of the country."

Kalijarvi admitted that Henry Holland, Assistant Secretary of State for Inter-American Affairs, disagreed with the official State Department position on the German bilateral.

Chan Gurney told the committee that on most international routes, U. S. carriers must stop in some country beyond London or Paris, and that ". . . our international service is hinged on Germany."

Pan Am's Argument

In explaining the large number of points proposed for service by American carriers in Germany, Gurney said that until a system of local service lines inside Germany establishes a main terminal point, it is to the advantage of U. S. international airlines to serve the points indicated in the proposed bilateral agreement.

Pan American, only U. S. carrier serving both Germany and South America, told the committee that the continuation of its rights to serve Germany and to fly beyond that country is extremely important both to the carrier and the United States. PAA Vice President Russell B. Adams said that PAA has no objections to trading the five American cities—New York, Boston, Philadelphia, Chicago and either Los Angeles or San Francisco—for five points now served by Pan Am in Germany. But the carrier did object to extensive "and beyond" rights for a German carrier to Latin America.

"When this case was pending before the Civil Aeronautics Board," said Adams, "Pan American warned that rights from Great Britain, Germany and other countries, for this dog-leg operation would have to be purchased, and that the price might be heavy. We are now beginning to see just how heavy the price is in the case of Germany; we do not yet know what it would be in the case of Great Britain and other countries."

Seek Route Definitions

Pan American took the position that Germany shouldn't get routes beyond the United States that are going to be supported chiefly by Fifth Freedom traffic.

On certain routes between Germany and Latin America—to Mexico, for instance—New York is on the logical course. On others, the inclusion of New York makes a dog-leg route. Adams pointed out that the "Great Circle" route mileage between Germany and Rio de Janeiro is 6,037 miles while the route via New York is 8,674 miles.

Adams said that such a route would have to subsist primarily on U. S.-Latin America traffic, since passengers traveling between Europe and Latin America would go by a more direct route.

The Pan American witness expressed the hope that the Latin American route proposed for Germany can be more sharply defined and limited. He said that the United States should not purchase a dog-leg route for TWA by the grant of a dog-leg route between Germany and South America via New York.

Adams also hopes that difficulties involved in the Germany negotiation will lead to development of procedures in which U. S. carriers are more closely informed of what is going on.

Gewirtz Criticizes House Monopoly View

"Freedom of entry" in air transportation "is merely a catchword employed for the age-old purpose of clothing personal aggrandizement in the raiment of broader appeal," Stanley Gewirtz, executive assistant to the president of Air Transport Assn., declared in testimony before the House Anti-Monopoly Subcommittee. Gewirtz was replying to charges that a monopolistic, "closed door" situation exists in the industry.

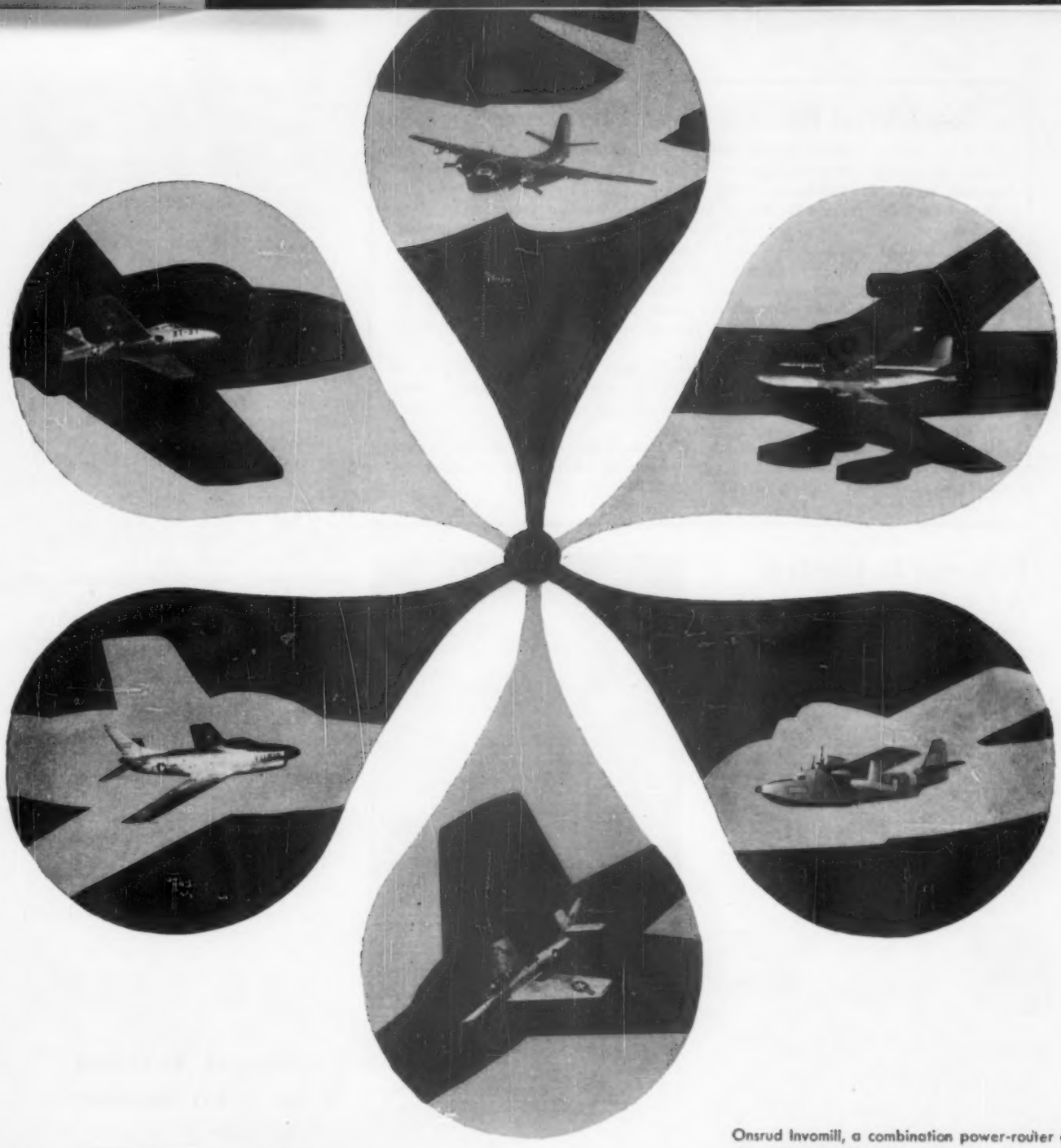
Sen. Wayne Morse (D.-Ore.), Sen. Joseph O'Mahoney (D.-Wyo.) and Rep. Henry Reuss (D.-Wis.) previously protested in their testimony before the subcommittee that Civil Aeronautics Board and the scheduled airlines have worked hand-in-hand to retain a monopolistic status quo and bar the entry of new carriers (AW May 16, p. 112).

Apparently referring to North American Airlines, Gewirtz said that those who have waived the "freedom of entry" banner have "combined in their own field to squeeze out their own little competitors." Calling this "a real manifestation of monopoly," he suggested that the anti-monopoly subcommittee investigate it.

"What the exponents of so-called 'freedom of entry' seek is just enough 'freedom of entry' to get their own coveted route awards, limited to the most lucrative traffic centers—and then let the door close behind them," Gewirtz said.

"The simple fact is that 'freedom' does not mean 'freedom' when used by the 'freedom of entry' advocates.

"No one seriously advocates freedom of entry in the sense the words would seem to imply—namely, that anyone could start airline service over any route at will," he said.



*Shape of things that come— *from* TWIN COACH

Piston or jet..single or multi-engine...trainer...interceptor, triphibian or tanker transport —Twin Coach Aircraft Division is probably unique among America's great subcontractors in its ability to produce major assemblies for many different aircraft types.

That's because we're *aircraft* specialists. Twin Coach Aircraft Division's five plants are devoted *exclusively* to production of airframe major assemblies. We build no other products...do no other work.

This is important because it means your airframe assemblies are built by experienced aircraft specialists... *men whose one aim is to produce to specification, on schedule, at the lowest possible cost.*

Onsrud Invomill, a combination power-router and skin-milling machine that can remove up to 150 cu. in. aluminum per minute, is just one of many hundreds of modern, high-speed machines. AA-1438

TWIN COACH COMPANY
Aircraft Division
BUFFALO, N. Y.

Other divisions of Twin Coach Company make:
PONY EXPRESS TRUCKS • FAGEOL GASOLINE AND PROPANE ENGINES
• FAGEOL-LEYLAND DIESEL ENGINES • FAGEOL AEROJET ENGINES

Lockheed Electra First Flight—1957

Burbank, Calif.—Lockheed Aircraft Corp. is planning the first flight of its turboprop Electra for October 1957. First delivery of the 414 mph. medium-haul transport to American Airlines is scheduled for 1958.

Before Lockheed starts deliveries on American's $65-million order for 35 of the new airliner (AW June 13, p. 12), three Electras will undergo simultaneous flight tests.

In a statement last week, Lockheed President Robert E. Gross said the new transport will have a top speed of about 450 mph. and a cruising speed of 414 mph., a 2,000 mi. range and accommodations for from 64 to 90 passengers. Performance figures are based on design proposals to power the Electra with four 3,750 hp. Allison 501 turboprop engines. But Gross said the powerplant for AA's new transport has not been finally selected.

Aerodynamic design of the transport indicates later versions of the Electra will be able to use turboprop engines up to 5,000 hp. for improved performance. Dimensions of the medium-range airliner include a wing area of 1,200 sq. ft., and 7.5 aspect ratio.

Lockheed has set up a production rate of 11 planes per month during the latter part of 1959. Gross said manufacturing personnel on the Electra series should increase steadily to a total work force of 5,000 by the end of 1958.

Pearson is Elected ATA President

Washington, D. C.—Harold L. (Pete) Pearson, 52, was elected president of the Air Transport Assn. last week (AW May 9, p. 11).

Presently serving as assistant director of the Bureau of the Budget, Pearson assumes his new duties July 1. He becomes the fourth president of 17-year-old association of the nation's scheduled airlines. He is succeeding Earl D. Johnson who resigned after serving a 16-month term to become a vice president of General Dynamics Corp.

Pearson previously served as Deputy Under Secretary of the Army with responsibility for logistics and financial management under Earl Johnson, outgoing president.

A native of Kansas City, Kan., Pearson's business career had been in the field of merchandising and financial management prior to entering government service in 1950. In addition to work with J. C. Penney and Sears Roebuck, he was associated with Montgomery Ward from 1928 until 1945 and was vice president and treasurer from 1940.

Pearson told AVIATION WEEK that the immediate problem is phasing out his work at the Budget Bureau in preparation for beginning the ATA job on July 1. He said there has been no commitment on the duration of his services, but added: "I hope to be there a long time. There was a mutually shared feeling that it was not a short-term assignment and yet I don't like long term contracts."

Pearson indicated he has no preconceived notions about industry problems. He said: "I am reading everything I can get my hands on and meeting as many airline officials as possible to discuss their problems. Some speech making will undoubtedly be required of me as a part of the all-important public relations responsibility of any trade association," Pearson stated.

HAROLD L. PEARSON

Other ATA board of directors' actions taken included the election of Robert L. Cummings, Jr., president of New York Airways, as a director by expanding the board to 11 members; approval of ATA's second half operating budget; and increasing the number of member carriers to 44 with the addition of Cordova Airlines, Reeve Aleutian Airlines and Northern Consolidated Airlines. The associate memberships of Pan American-Grace Airways and Wien Alaska Airlines were changed to full memberships.

Airlines Will Seek Balboa Agreement

The airlines involved in the New York-South America interchanges proposed by the Civil Aeronautics Board in the Balboa case got together last week to work out necessary agreements.

The Board extended its June 20 deadline to June 30 to allow Eastern Air Lines, Braniff Airways, National Airlines, Pan American World Airways and Pan American-Grace Airways added time to work out agreements for operation of the two proposed interchanges.

Originally, CAB gave the carriers sixty days to present plans for the service. Pan American and Eastern waited until a few days before June 20 before announcing they would go ahead with the National-Pan American and Eastern-Braniff interchanges the Board asked them to set up.

Both pairs of carriers were conducting negotiations last week to conclude agreements before the June 30 filing date.

While Eastern and Pan American were deciding whether or not to oppose the CAB Balboa decision, National and Panagra worked out an agreement for an interchange and filed it with the Board. The agreement didn't include Pan American, over whose route Panagra would have to operate between the Canal Zone and Miami to meet National.

Under the Panagra-National plan, National would take over Panagra's aircraft at Miami on a charter basis and fly them between Miami and New York. National would operate one first class and one tourist flight daily for Panagra, with provisions for additional flights.

The through-flight agreement under which Panagra flies between the Canal Zone and Miami over a Pan American route is contingent on the agreement reached among the carriers on an interchange and must be approved by the Board along with the interchange agreement.

Piedmont Aviation Wins CAB Support

Extension of Piedmont Aviation's route system to Washington, D. C., has been recommended by Civil Aeronautics Board Examiner Richard A. Walsh.

Walsh recommends amendment of Piedmont's certificate to authorize service between Lynchburg, Va., and Washington via Charlottesville, Va., for an experimental three year period. He suggests that Piedmont be prohibited from operating one-plane service between Washington and Danville, Richmond and Norfolk, Va., and Winston-Salem and Greensboro/High Point, N. C.

The application of the City of Staunton, Va., for air service would be denied under the examiner's recommendations.

From the Ground Up...

UNSURPASSED ACCURACY WITH *Collins* VOR

Collins the leader in the development of airborne and terminal VOR-equipment, offers a complete station of unsurpassed accuracy and reliability. The inherent stability of the antenna is dependent entirely on mechanical symmetry and is not influenced by time or moisture. Amplitude and phase changes on the two antenna feed lines may be tolerated with no effect on bearings. Critical phasing adjustments or cutting of r-f lines to exact length are not necessary.

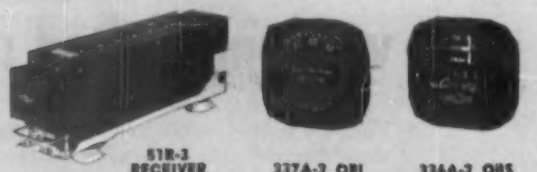
A tone-wheel FM subcarrier generator provides increased reliability. Since the center frequency is permanently fixed, no adjustments or expensive test equipment are required for maintenance. The problems of frequency drift and tube failure are eliminated.

Facilities are included to measure bearing accuracy in eight directions, eliminating the need for an expensive phase standard or flight checks.

The final RF amplifier is operated at only 2/3 its power rating. Ruggedized ARINC tubes are used throughout.

Automatic voice or code identification is provided at no extra cost. Navigation information is automatically removed if the percentage modulation changes 15% up or down or if the bearing shifts ±1 degree.

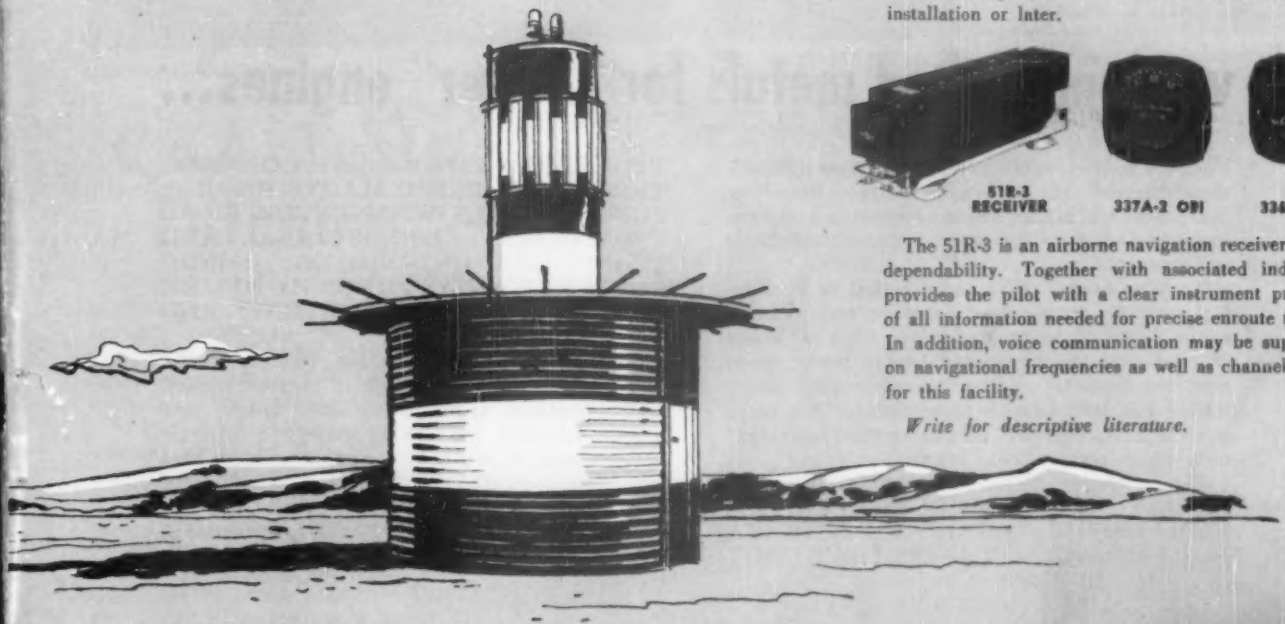
The services of Collins field service organization are available to provide assistance if needed at the time of installation or later.



51R-3 RECEIVER | 337A-2 OBI | 336A-2 OBS

The 51R-3 is an airborne navigation receiver of proven dependability. Together with associated indicators, it provides the pilot with a clear instrument presentation of all information needed for precise enroute navigation. In addition, voice communication may be superimposed on navigational frequencies as well as channels provided for this facility.

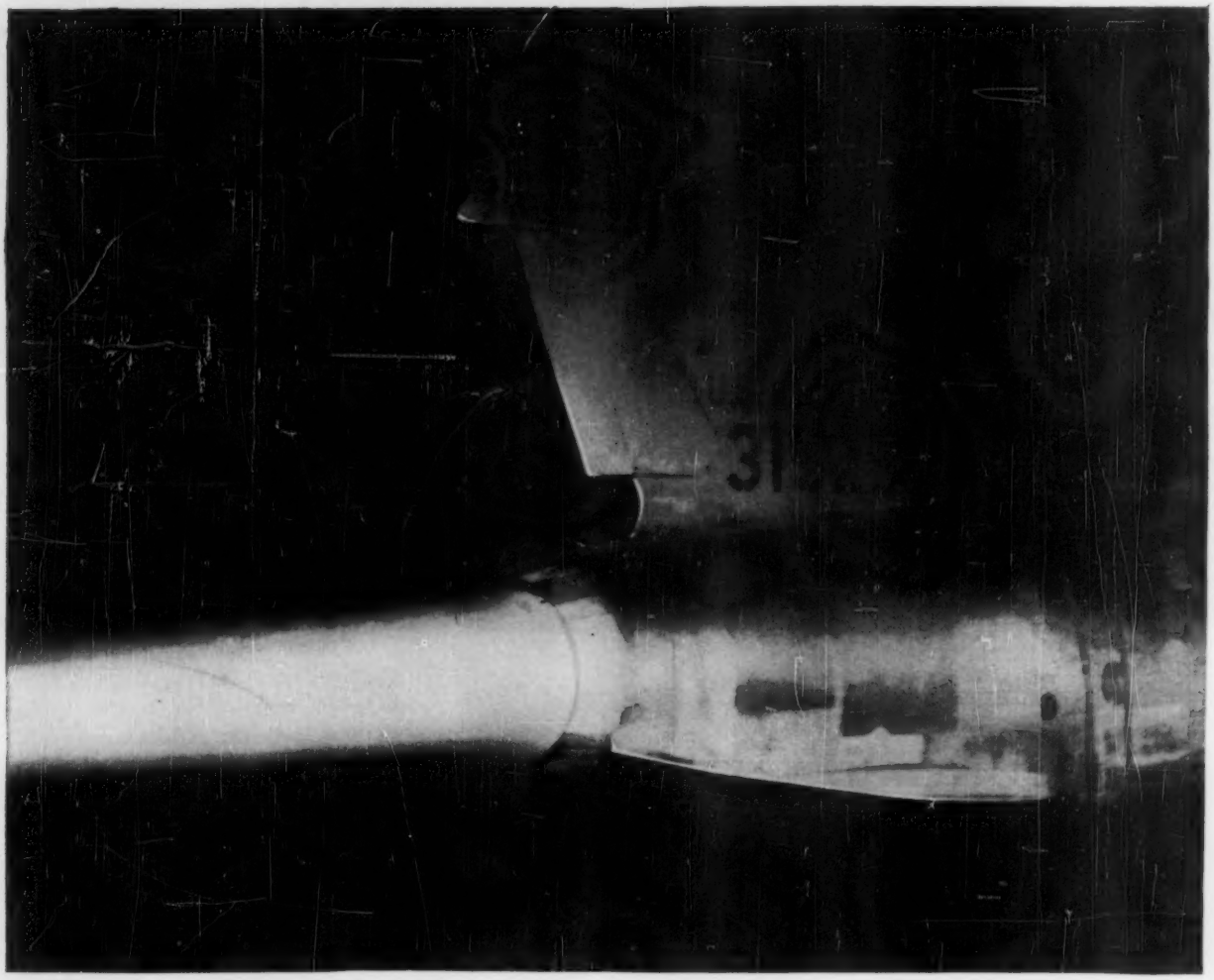
Write for descriptive literature.



COLLINS RADIO COMPANY | **CEDAR RAPIDS, IOWA**

1930 Hi-Line Drive, DALLAS 2, TEXAS
2700 W. Olive Avenue, BURBANK, CALIFORNIA
261 Madison Avenue, NEW YORK 16, NEW YORK
1200 18th Street N. W., WASHINGTON, D. C.
COLLINS RADIO COMPANY OF CANADA LTD.
74 Sparks Street, OTTAWA, ONTARIO

COLLINS



Tail section of North American F-100

vacuum-melted metals for "hotter" engines...

Vacuum-melted metals are breaking the "thermal-metal-barrier" of jet engine design. For they make possible higher engine operating temperatures, under conditions where conventional alloys fail rapidly.

Turbine blades of vacuum-melted superalloy, for example, were tested together with comparable blades of air-melted alloy. After 40 hours of operation the air-melted blades broke when bent less than 90° . . . the vacuum-melted blades took a full 180° bend without failure! For main shaft ball bearings, too, vacuum-melted metals far outperform conventional alloys.

Here's why . . . VACUUM MELTING LITERALLY SUCKS GASEOUS IMPURITIES FROM THE MOLTEN METAL...REMOVES INCLUSIONS AND GASSES THAT LIMIT THE PERFORMANCE OF CONVENTIONAL AIR-MELTED ALLOYS. RESULT: PURER METALS WITH EXCEPTIONAL PROPERTIES . . . LONGITUDINAL AND TRANSVERSE UNIFORMITY . . . HIGHER CREEP AND STRESS RUPTURE STRENGTH...BETTER DUCTILITY AND FATIGUE STRENGTH.

Vacuum Metals Corporation, pioneer in the development and production of vacuum-melted and cast alloys, is producing these unique new metals designed for a wide variety of aircraft applications. If you have a metals problem that vacuum-melted alloys might solve, please describe it in as much detail as possible. Write *Vacuum Metals Corporation, P. O. Box 977, Syracuse 1, New York.*

VMC

VACUUM METALS CORPORATION

Jointly owned by Crucible Steel Company of America and National Research Corporation

96

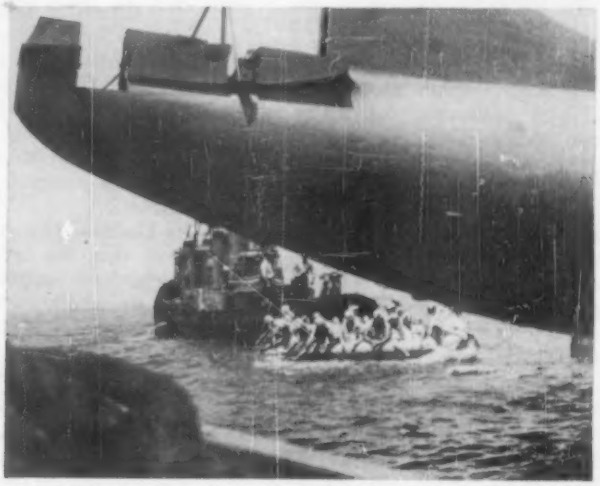
Senate Boosts Subsidy Fund

in the investigation of intra-Alaska air services case.

LAUNCHING of 20-man life raft from "ditched" 4-0-4 takes 38 sec.

VOLUNTEERS EVACUATE from door and windows in 3:04 min.

CROWDED RAFT leaves plane 3:37 min. after test began.



ALL 40 EVACUEES are in single raft. Other raft inflated in cabin.

CAA Tests Ditching

Norfolk, Va.—Requirements for faster evacuation of passengers from ditched transport planes and improved survival equipment were studied by Civil Aeronautics Administration during simulated trials at sea near here recently.

Forty CAA volunteers, including 13 women, played the parts of typical airline passengers during Operation Ditch. A Martin 4-0-4 fuselage buoyed with steel drums, provided the stage setting for the study.

Cameras recorded the times it took passengers to escape into the Garrett Corp. Air Cruiser Division's 20-man life raft, free the raft and clear it from the "sinking" plane.

Operation Ditch is part of a continuing program by government and industry to improve emergency procedures and survival after water landings.

AS RAFT FLOATS AWAY from buoyed Martin 4-0-4, a "survivor" is pulled aboard.

Senate Boosts Subsidy Fund

Washington, D. C.—The Senate increased funds for Fiscal 1956 airline subsidy payments $15 million over the $40 million approved by the House on a 51 to 24 roll-call vote—despite two days' opposition debate led by Sen. Paul Douglas (D.-Ill.) and directed primarily against Pan American World Airways.

The $55 million approved by the Senate, though, is still $8 million less than the $63 million requested by the Civil Aeronautics Board.

The Senate also voted the Board its full request of $4,125,000 for administrative activities to make possible a speed-up of action on mail and route cases (AW June 6, p. 130). This is $225,000 more than the House approved and $348,000 more than CAB's Fiscal 1955 budget.

The differences between the House and Senate figures will be resolved by a joint conference committee of the two houses.

Is Congress Obligated?

Key issue in the lengthy Senate debate over the boost in subsidy funds was whether Congress is legally obligated to appropriate money for making good on payments determined by CAB in accordance with the terms of the 1938 Civil Aeronautics Act.

Douglas maintained that Congress is not obligated to do so.

He said: "In a democracy, the appropriating body is the legislature. We can never allow an administrative agency to tie up the representatives of the people and commit appropriations in advance of the congressional action providing them. He presented an opinion by James Radigan, American Law Division of the Library of Congress, to support his claim that "the CAB does not have the authority to obligate funds for subsidies without action directly by the Congress."

Sen. Spessard Holland (D.-Fla.), chairman of the subcommittee on CAB appropriations, protested that the Congress should not "strangle contractors with the United States who have established their businesses and are operating them on the faith of the present law and in the belief that Uncle Sam will be honest and fair and will pay the obligations due them."

He added that "if the Congress should refuse to recognize the obligations of the U. S. ultimately there would be chaos."

Holland said that Douglas was "evidencing no confidence" in CAB or in the General Accounting Office which audits CAB accounts.

Douglas replied that "the GAO and, particularly, the CAB, have been negligent in the performance of their duty, to put it mildly, and I stand on that."

Holland's Rebuttal

If there is objection to subsidies or lack of confidence in the members of the Board, Holland declared, the "proper way to proceed" is to amend the 1938 act authorizing the subsidies or to oppose the confirmation of CAB members who it might be felt "have not been diligent in the discharge of their duties."

Five Republicans and 19 Democrats sided with Douglas in opposing the boost in the subsidy money, including the chairmen of three committees: Chairman Warren Magnuson (D.-Wash.) of the Commerce Committee; Chairman John Sparkman (D.-Ala.) of the Small Business Committee; and Chairman Harry Byrd (D.-Va.) of the Finance Committee.

Sen. Mike Monroney (D.-Okla.), chairman of the Commerce Subcommittee on Aviation, voted with the 51 majority supporting Holland on the increase.

Douglas' primary charge against PAA was that the carrier is using subsidy money to support the luxury hotels of its wholly-owned subsidiary, International Hotels Corp.

CAB ORDERS

(June 9-15)

GRANTED:

Resort Airlines a postponement of approximately six months in procedural dates in the carrier's certificate renewal case.

Flying Tiger Line an exemption to perform two charter flights between San Francisco and Tokyo pursuant to a contract with Moral Re-Armament.

Aero Finance Corp. an exemption to perform five round trip charter flights between Cincinnati, Ohio, and Lac des Loups, Canada, pursuant to a contract with Mr. Jim Thomas.

Flying Tiger Line an exemption to perform one round trip charter flight each for World Travel Exchange and International Research Fund from Brussels and/or Amsterdam to New York and return, providing FTL doesn't charter an entire aircraft to more than one entity and make certain increases in its rates.

Seaboard and Western Airlines an exemption to perform three round trip charter flights between New York and Prestwick, Scotland, pursuant to an agreement with the Scottish Compass Travel Club.

Jack Carr Service, Inc., an exemption to engage in air transportation of persons and property between Anchorage, Alaska, and any other point within the Territory of Alaska, until sixty days after final decision in the investigation of intra-Alaska air services case.

United Airmotive, Inc. an exemption to engage in air transportation of persons and property between Anchorage and any other point within a 250 mile radius of Anchorage, Alaska, until sixty days after final decision in the investigation of intra-Alaska air services case.

Trans Ocean Air Lines an exemption permitting the carrier to acquire control of Flight Enterprises, Inc. Interlocking relationships between Transocean Flight Enterprises, S. L. Wilson, E. W. Ringo and J. A. Reilly are approved.

Aerovias Venezolanas, S. A., permission to serve Miami through the Miami International Airport.

APPROVED

Agreements between Pan American World Airways, Canadian Pacific Airlines and various other carriers relating to intercarrier arrangements.

Resolutions between carriers adopted by the International Air Transport Assn. relating to Amsterdam-Tokyo fares via the Polar route.

ORDERED:

Canadian Aero Services Ltd.'s authority to conduct an airborne magnetometer survey of Duke Island, Alaska, be continued for twenty days.

Approval of an agreement between various carriers relating to the regulation and conduct of the Regional Traffic Conferences of the International Air Transport Assn. be extended.

South Pacific Air Lines' application for irregular and/or charter service be consolidated with its application for a certificate for service between Hawaii and the Society Islands via Christmas Island.

Bonanza Air Lines' temporary mail rate be set at 45.68 cents for the period starting Apr. 25, 1955.

Proceeding involving mail rates for Slick Airways, Flying Tiger Line and Riddle Airlines for carriage of surface mail be consolidated with the proceeding involving surface mail rates for trunk carriers.

Currey Air Transport, Ltd.'s operating exemption be suspended unless Currey files certain delinquent reports by June 23, 1955.

DISMISSED:

Northeast Airlines' application for a temporary service mail rate between certain points, since the Board has established final service mail rates for the domestic trunkline carriers.

Trans Caribbean Airways' application for approval of acquisition of Avispa stock, at the request of the carrier.

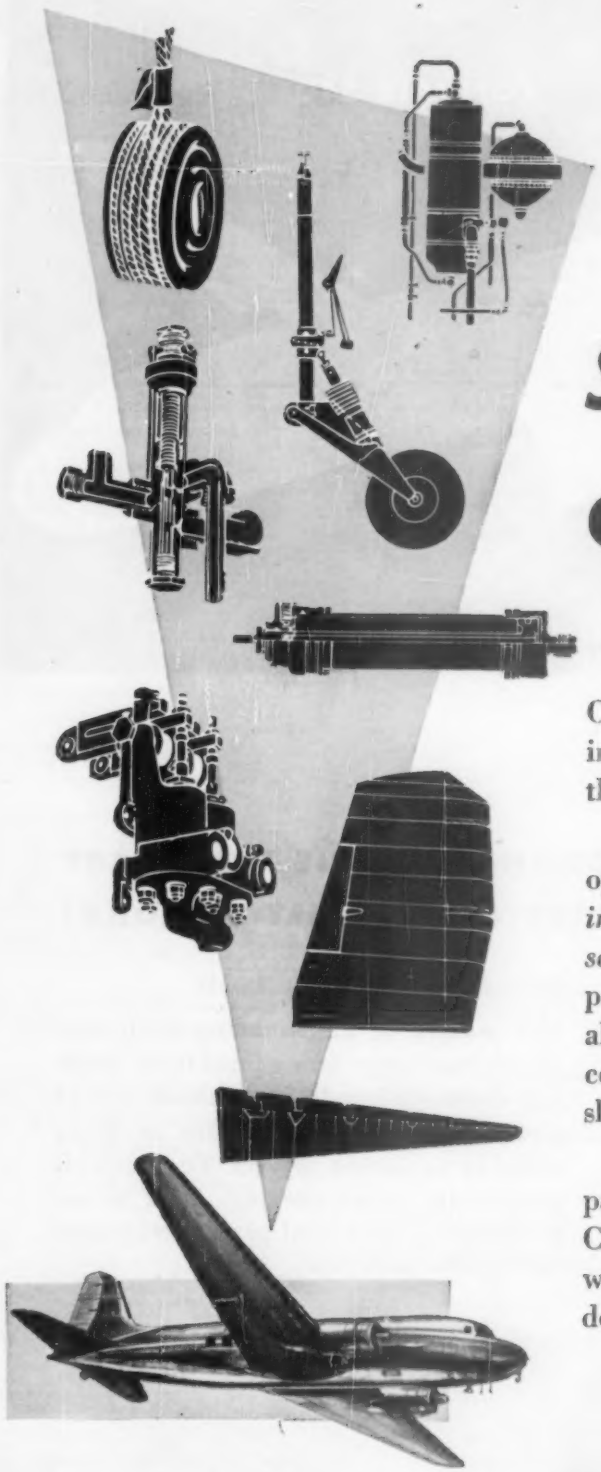
Southeastern Airlines' application for an air mail certificate, since applicant failed to affirm its desire to prosecute application.

Air Cargo Express' application for a certificate of public convenience and necessity, since the applicant failed to affirm its desire to prosecute the application.

Henry J. Haldeman's application for a certificate of public convenience and necessity, since the applicant failed to affirm his desire to prosecute the application.

DENIED:

National Airlines' petition for reconsideration in the Eastern-Colonial control case.



SPARE PARTS
for
C47/DC3 TYPES

Canadair supplies spare parts for C47/DC3 type aircraft to over 100 airlines in 45 different countries...among them the world's foremost aircraft operators.

Why do they come to us? Because operators know that only airplanes *in the air* make money and *we give top service*. Components, assemblies, detail parts, hardware and vendor items are all in stock and airframe parts are constantly in production. Orders are shipped promptly.

If you need DC3/C47 type spare parts, it will pay you to deal with Canadair—an established company with a world-wide reputation for dependability.

Write, wire or 'phone:

C-L CANADAIR LIMITED

CANADAIR

— AIRCRAFT MANUFACTURERS —

LIMITED, MONTREAL, CANADA

A subsidiary of GENERAL DYNAMICS CORPORATION, New York, N.Y. — Washington, D.C.

CARS-11187

KNOW-HOW . . . THE VITAL PART OF EVERY PART THAT'S BUILT BY ROHR!

ROHR has become famous as the world's largest producer of ready-to-install power packages for airplanes . . . like the all-jet Boeing B-52, Convair Liner, Douglas DC-7, Lockheed Constellation and other great military and commercial planes.

Currently, ROHR aircraftsmen are producing over 30,000 other different parts for aircraft of all kinds.

The wealth of engineering skill and production know-how gained from building these thousands upon thousands of power packages and millions of other parts is available to you. For aircraft parts better, faster, cheaper . . . call on our know-how . . . the vital part of every part that's built by ROHR.

WORLD'S LARGEST PRODUCER

OF READY-TO-INSTALL POWER PACKAGES FOR AIRPLANES

-RECIPROCATING, TURBO-PROP, TURBO-COMPOUND AND JET

ROHR

AIRCRAFT CORPORATION

CHULA VISTA AND RIVERSIDE, CALIFORNIA

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—JUNE 27, 1955

AEROJET-GENERAL CORPORATION 75
Agency—D'Arcy Adv. Company
AEROPRODUCTS ALLISON DIV., GENERAL MOTORS CORP. 64
Agency—Campbell-Ewald Company
AEROQUIP CORPORATION 49
Agency—The Fred M. Randall Company
AIRBORNE ACCESSORIES CORP. 20
Agency—Gray & Rogers Adv.
AIRCRAFT BOLT CORP. 72
Agency—Elmer W. Ayer Adv.
AIRESEARCH MFG. DIVISION THE GARRETT CORP. 5
Agency—J. Walter Thompson Co.
ALLISON DIV., GENERAL MOTORS CORP. Fourth Cover
Agency—Kudner Agency, Inc.
ARO EQUIPMENT CORP. THE 43
Agency—Beeson-Reichert, Inc.

BEECH AIRCRAFT CORP. 10
Agency—Associated Advertising Agency, Inc.
BENDIX RADIO DIV., BENDIX AVIATION CORP. 82-83
Agency—MacManus, John & Adams, Inc.

CANADAIR, LTD. 99
Agency—Walsh Advertising Co., Ltd.
CITIES SERVICE OIL CO. 24
Agency—Ellington & Co., Inc.
CLIFFORD MFG. CO., DIV. OF STANDARD-THOMSON CORP. 40-41
Agency—Shattuck, Clifford & McMillan, Inc.
COLE ELECTRIC COMPANY 51
Agency—Taggart & Young Adv.
COLLINS RADIO COMPANY 85
Agency—W. D. Lyon Co., Inc.
CONTINENTAL MOTORS CORP. 26
Agency—The Hopkins Agency
CONVAIR A DIVISION OF GENERAL DYNAMICS CORP. 74
Agency—Thomas L. Yates Adv. Agency
CRAIG, INC. 58
Agency—Larcom Randall Adv.

DARNELL CORP., LTD. 39
Agency—Rhea Advertising

EASTERN INDUSTRIES, INC. 66
Agency—Reuben Adv. Agency, Inc.
EDGEWATER STEEL COMPANY 71
Agency—Walker & Downing Industrial Adv.
EDISON, INC., THOMAS A. (INSTRUMENT DIV.) 34
Agency—Gaynor & Co., Inc.
ELECTRICAL ENGINEERING & MFG. CORP. 19
Agency—West-Marquis, Inc.
ELECTRO MECHANICAL RESEARCH, INC. 54
Agency—Moore & Company, Inc.
ENJAY COMPANY, INC. 35
Agency—McCann-Erickson, Inc.

FULTON SYLPHON DIV., ROBERTSHAW-FULTON CONTROLS CO. 86
Agency—Arndt-Preston-Chapin-Lamb & Keen, Inc.

GARRETT CORP. THE AIRESEARCH MFG. DIVISIONS 5
Agency—J. Walter Thompson Co.
GENERAL MILLS, INC. (MECHANICAL DIVISION) 88-89
Agency—Batten, Barton, Durstine & Osborn, Inc.
GOODRICH CO., THE B. F. (AERONAUTICAL SALES) 3
Agency—Batten, Barton, Durstine & Osborn, Inc.

HARRISON RADIATOR DIV., GENERAL MOTORS CORP. 70
Agency—D. P. Brother & Co. Adv.
HARVEY ALUMINUM DIV. OF HARVEY MACHINE CO., INC. ..... Third Cover
Agency—Hixson & Jorgensen, Inc.
HECKER COMPANY, A. W. 101
Agency—H. Grider Adv. Inc.
HI-SHEAR RIVET TOOL COMPANY, THE 8

INLAND TESTING LABORATORIES 65
Agency—Merrill McEnroe & Associates, Inc.

KAWNEER COMPANY, THE (AIRCRAFT PRODUCTS DIV.) 45
Agency—Fuller & Smith & Ross, Inc.
KAYNAR COMPANY, THE KAYLOCK DIV. Second Cover
Agency—J. H. Strauss & Co.

LOUD MACHINE WORKS, INC., H. W. 27
Agency—Walter C. Davison Co.

MANNING, MAXWELL & MOORE, INC. (AIRCRAFT PRODUCTS DIV.) 59
Agency—Fuller & Smith & Ross, Inc.
MINNEAPOLIS HONEYWELL REGULATOR CO. Front Cover
Agency—Foote, Cone & Belding

NORTHROP AIRCRAFT, INC. 65
Agency—West-Marquis, Inc.
NUTT-SHEL MANUFACTURING COMPANY 32
Agency—Welsh, Hollander & Coleman Adv.

PARAMETERS, INC. 58
Agency—Duncan Brooks, Inc., Adv. Agency
PASTUSHIN AVIATION CORP. 6
Agency—Lynn-Western, Inc.
PIASECKI HELICOPTER CORP. 57
Agency—B. K. Davis & Bro.

RED BANK DIV., BENDIX AVIATION CORP. 48
Agency—MacManus, John & Adams, Inc.
RED SEAL METALS CO. 68
Agency—Heintz & Co., Inc.
RESISTOFLEX CORP. 67
Agency—Marsteller, Rickard, Gebhardt & Reed, Inc.
ROBINSON CO., RALPH C. 71
Agency—Chapin-Damm Adv.
ROEBLING'S SONS CORP., JOHN A. 4
Agency—Beatty & Oliver, Inc.
ROHR AIRCRAFT CORPORATION 71-100
Agency—Barnes Chase Company

SAWYER & SON CO., THE H. W., (COATED FABRICS DIV.) 38
Agency—Shattuck, Clifford & McMillan, Inc.
SCINTILLA DIV., BENDIX AVIATION CORP. 22
Agency—MacManus, John & Adams, Inc.
SCOVILL MANUFACTURING CO. (AIRCRAFT FASTENERS DIV.) 47
Agency—Needham, Louis and Brorby, Inc.
SEARCHLIGHT SECTION 76, 77, 78, 79, 80, 81, 82, 83, 84, 85
SKINNER DIVISION OF BENDIX AVIATION CORP. 42
Agency—MacManus, John & Adams, Inc.
SKYLINE PRODUCTS, INC. 72
Agency—Triton Adv.
STANDARD PARTS AND EQUIPMENT CORP. 25
Agency—Glenn Advertising, Inc.
STEEL PRODUCTS ENGINEERING CO. 56
Agency—Geyer Advertising, Inc.
STILLMAN RUBBER CO. 60
Agency—Lynn-Western, Inc.

THIOKOL CHEMICAL CORP. 73
Agency—R. W. Westervelt & Co. Adv.
TOPP INDUSTRIES, INC. 8
Agency—Willard G. Gregory & Co.
TWIN COACH CO., AIRCRAFT DIVISION 93
Agency—Palm & Patterson, Inc.

UNITED AIRCRAFT PRODUCTS, INC. 23
Agency—Weber, Geiger & Kalat, Inc.

VACUUM METALS CORPORATION 96
Agency—G. M. Basford Co.
VICKERS-ARMSTRONG LTD. (AIRCRAFT DIVISION) 90
Agency—McCann-Erickson, Inc.
VICKERS, INC. A DIV. OF THE SPERRY CORP. 30
Agency—Witte & Burden Adv.

WESTERN GEAR WORKS 69
Agency—Ruthrauff & Ryan, Inc.
WESTINGHOUSE ELECTRIC CORP. 61-62-63
Agency—Fuller & Smith & Ross, Inc.
WICKES ENGINEERING & CONSTRUCTION CO. 60

ZEPHYR MANUFACTURING CO., INC. (SALES DIV.) 33
Agency—The Perrett Co. Adv.

SEARCHLIGHT SECTION

(Classified Advertising)

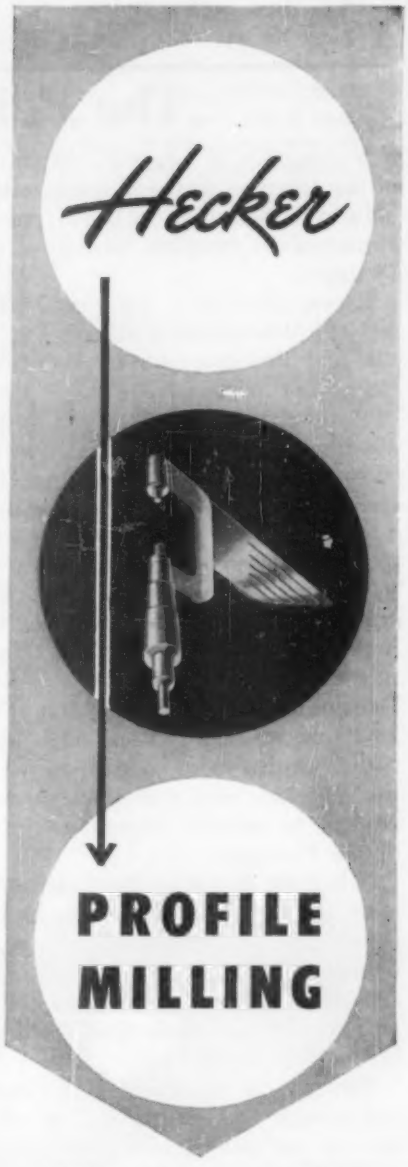
F. J. EBERLE, Ass't. Mgr.

EMPLOYMENT
Positions Vacant 77-85
Selling Opportunities Offered 82
Positions Wanted 84
Selling Opportunities Wanted 84
Employment Agencies 82

SPECIAL SERVICES
To the Industry 84

PLANES—EQUIPMENT
(Used or Surplus New)
For Sale 76-77

WANTED
Planes—Equipment 78



Hecker offers you complete machining capacity including contour milling up to 36" wide x 120" long for airframe parts. Our 20 years of aircraft experience assures you of highest quality machining — always.

Send blueprints for immediate quotations.

Designers and Builders

Tools • Jigs • Fixtures • Special Machinery

Manufacturers of Machined Metal Parts

SINCE 1931

A. W. Hecker CO.

7200 EUCLID AVENUE
CLEVELAND 3, OHIO

EDITORIAL

The Poisonous Fog of Censorship

A rising tide of vigorous criticism from all segments of the American press and many portions of the aircraft industry is beginning to engulf the efforts of R. Karl Honaman to establish peacetime censorship in the Pentagon.

Recent editorials in the New York World Telegram and the Washington Post and Times Herald attacked the new Pentagon policy. A distinguished leader of the aircraft industry, Frederick B. Rentschler, chairman of United Aircraft Corp., commented sharply on the absurdity of present military information restrictions.

Mr. Honaman, a Bell Laboratories' executive, has embarked on a government career based on promoting a policy of official censorship of unclassified military and technical information. We have watched Mr. Honaman's Washington career closely from the time a few months ago when he joined the Commerce Department as the head of its Office of Strategic Information until his recent appointment as Deputy Assistant Secretary of Defense for Public Affairs. During this brief period we have seen his policy change from a publicly expressed aim to see that more information was made available to the American press and people to his latest audacious attempt to establish himself as the peacetime censor of the Pentagon.

Before the advent of Mr. Honaman at the Pentagon, most of the public relations problems—and they were many—concerned the exact point at which the line of military security classification should be drawn. An admittedly difficult problem requiring the considered judgment of technically qualified people, it has never been solved satisfactorily.

However, Mr. Honaman ignored this genuine problem and plunged immediately into an effort to restrict the flow of unclassified information from the Pentagon. In this effort he had support from Mr. Charles E. Wilson, the Secretary of Defense, who appointed him to the Pentagon job. Secretary Wilson already had established a policy that nonclassified information should be withheld from the public if it did not make a "constructive contribution" to the Defense Department mission.

Now, Mr. Honaman has gone even further in the direction of peacetime censorship. To Secretary Wilson's "constructive" yardstick, he has added the criterion that information must be "useful, valuable or interesting" before the Defense Department will make it available to public and press. Who will be the judge of whether information is "useful, valuable, interesting or constructive?" Why Mr. Honaman, of course!

By his latest policy statements, expressed in letters to J. Russell Wiggins, managing editor of the Washington Post and Times Herald and chairman of the Freedom of Information Committee of the American Society of Newspaper Editors, Mr. Honaman attempts to tell the American public what they can and should read about their national defense effort. He also is attempting to tell every editor of an American publication what he can and should print about this vital endeavor.

No editor worth his salt will accept Mr. Honaman's latest policy on Defense Department information. Nor will the American public stand for a Pentagon bureaucrat deciding what they can or should know about one of their government's most important missions.

The sordid tale of how this policy was used to conceal the accurate and complete story of the Russian airpower displays over Moscow is still fresh in the public memory. New absurdities emanate from the Pentagon every day.

Although every Russian in Moscow and hundreds of foreign observers had an opportunity to see the new Red Air Force jet fighters and bombers two months ago, the Pentagon still will not release pictures of these aircraft to the American public.

Although pictures of the giant Martin P6M SeaMaster have been officially released by the Pentagon, it is trying to keep secret the first flight of this huge plane powered by four roaring turbojets with loud-popping afterburners as it speeds over Baltimore (population 1,337,373).

Although the Northrop Snark and Bell Rascal guided missiles have been parked on public airports on occasions stretching back more than a year ago and although the Air Force has officially de-classified external pictures, the Pentagon is still trying to keep these pictures from the public.

Although the Pratt & Whitney J57 has been produced by the thousands, has been in widespread service for several years, and is handled by thousands of mechanics and dissected and overhauled by thousands more people, and although thousands of copies of its unclassified technical manuals have been printed and distributed by USAF and Navy, the Pentagon still treats this engine as an official secret.

This poisonous fog of censorship that is settling over the Pentagon at the direction of Secretary Wilson and his aide R. Karl Honaman will have serious effects on the aircraft industry if it is not checked soon. It will further retard our technical progress in airpower development; it will complicate aircraft firms' relations with their stockholders and it will seriously handicap American industry in its international competition.

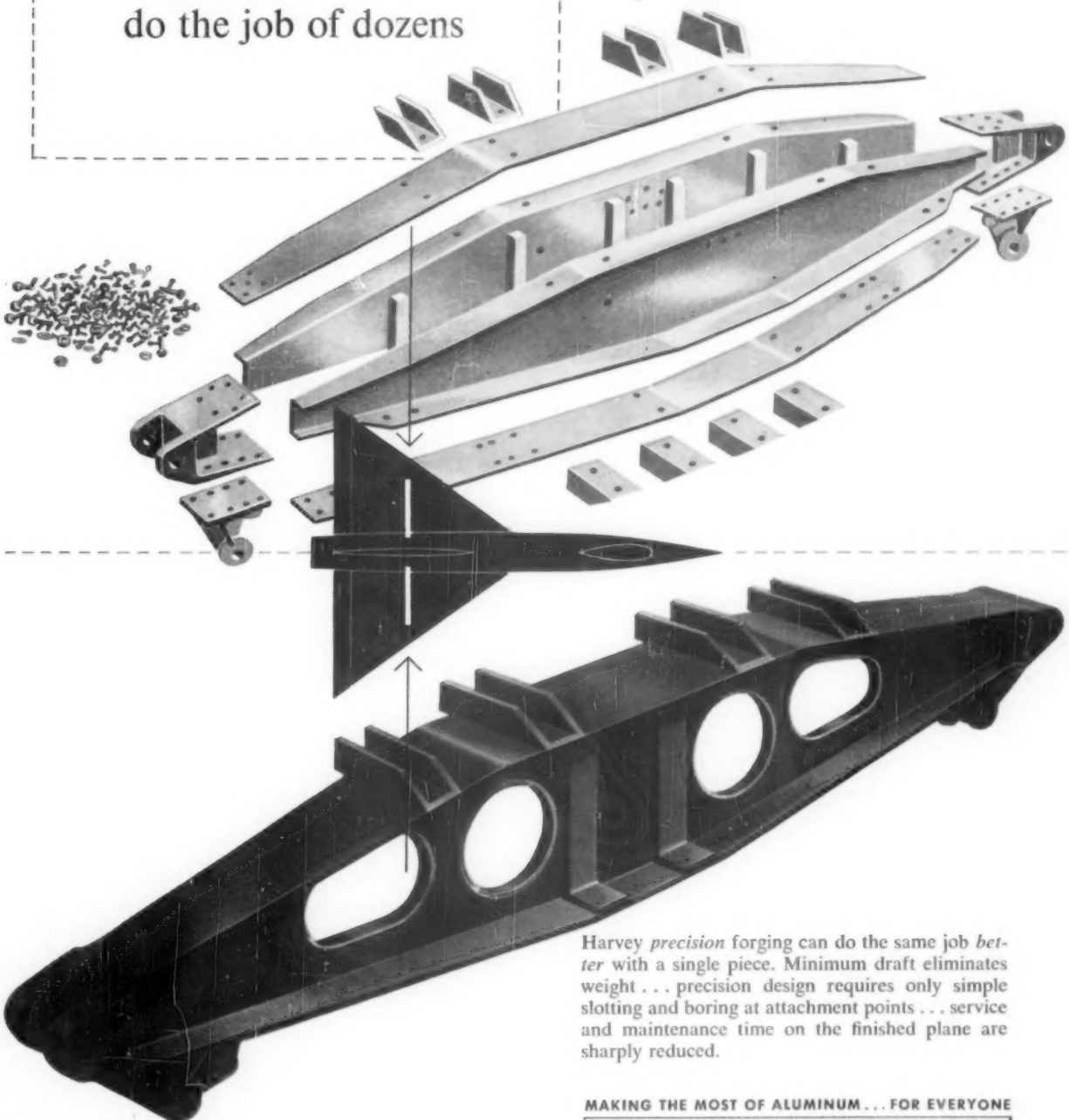
The Wilson-Honaman information policies have no place on the American scene. We agree with Managing Editor Wiggins when he asked Mr. Honaman and the American press to remember a declaration that Thomas Jefferson made in another national crisis 157 years ago:

"Your fellow citizens think they have a right to full information in a case of such great concernment to them. It is their sweat which is to earn all the expenses of the war and their blood which is to flow in expiation of the causes of it."

—Robert Hotz

Harvey precision forgings... making one part do the job of dozens

Here's an aircraft beam . . . made the old way. Each one of the pieces you see must be handled separately, brought to an assembly area, laboriously put together with upwards of 40 bolts, almost 200 rivets. And it's only one of many similar beams in a typical modern plane.



Harvey *precision* forging can do the same job *better* with a single piece. Minimum draft eliminates weight . . . precision design requires only simple slotting and boring at attachment points . . . service and maintenance time on the finished plane are sharply reduced.

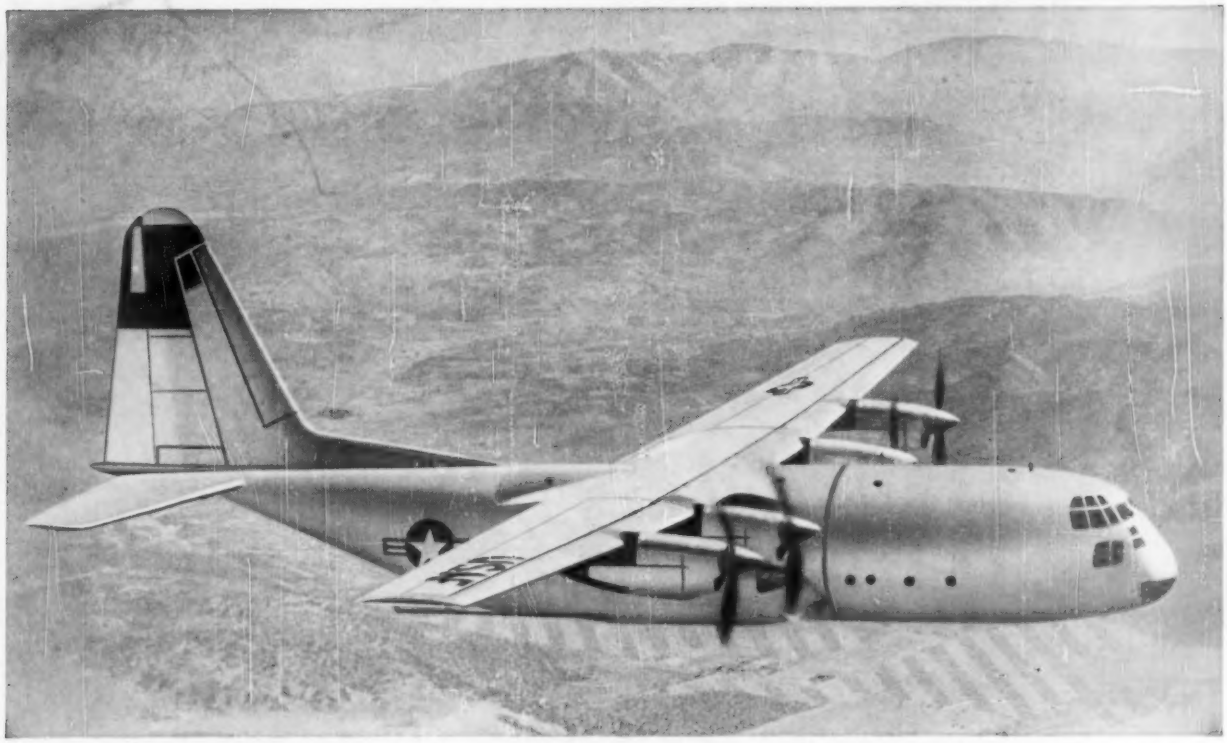
MAKING THE MOST OF ALUMINUM . . . FOR EVERYONE

HARVEY Aluminum

RESEARCH . . . DEVELOPMENT . . . PRODUCTION

Harvey does all three as a leading independent producer of aluminum extrusions in all alloys and all sizes, special extrusions, press forgings, hollow sections, structurals, rod and bar, forging stock, pipe, tubes, impact extrusions, aluminum screw machine products and related products. Also similar products in alloy steel and titanium on application.

HARVEY ALUMINUM SALES, INC., TORRANCE, CALIFORNIA—BRANCH OFFICES IN PRINCIPAL CITIES



First Flight of the **Hercules**

powered by America's first production Turbo-Prop engines

A NEW era in America's military transport operations was opened when the U.S. Air Force's first production Turbo-Prop cargo transport, the Lockheed C-130A Hercules, took off from Dobbins Air Force Base, Georgia.

Powered by four Allison T56 Turbo-Prop engines, the 54-ton transport was air-borne eight seconds after the brakes were released and climbed to 2,500 feet by the time it passed over the end of the 10,000-ft. runway. Test Pilot B. A. (Bud) Martin said: "It is the finest flying airplane I have ever operated."

Developing more than 2.3 horsepower per pound of engine weight, and with a frontal area approximately half that of present transport piston engines, the 3750-h.p. T56 gives the four-engine Hercules a speed exceeding that of many World War II fighters.

A commercial version of the military engine – the Allison Model 501 – will bring new standards of faster, quieter, more comfortable air travel in airliners that can operate from any airport now served by commercial air carriers. And, with its economical use of lower-cost fuel, this new engine will substantially reduce the operating cost of the all-cargo transport.

These great new Turbo-Props reflect the knowledge Allison has gained in designing and building gas turbine engines which have flown more than six million hours. These engines are daily flying the equivalent of one hundred trips around the world—*experience where it counts most—in the air.*

ALLISON Division
of General Motors
Indianapolis, Indiana
Builder of Turbo-Jet and Turbo-Prop Aircraft Engines

GM
AIRCRAFT POWER

ALLISON
TURBO-PROP ENGINES
American built for the new era in air travel

Opportunities for engineers in Allison's $75 million expansion of aircraft engine research and development facilities. Write: Technical Employment Section